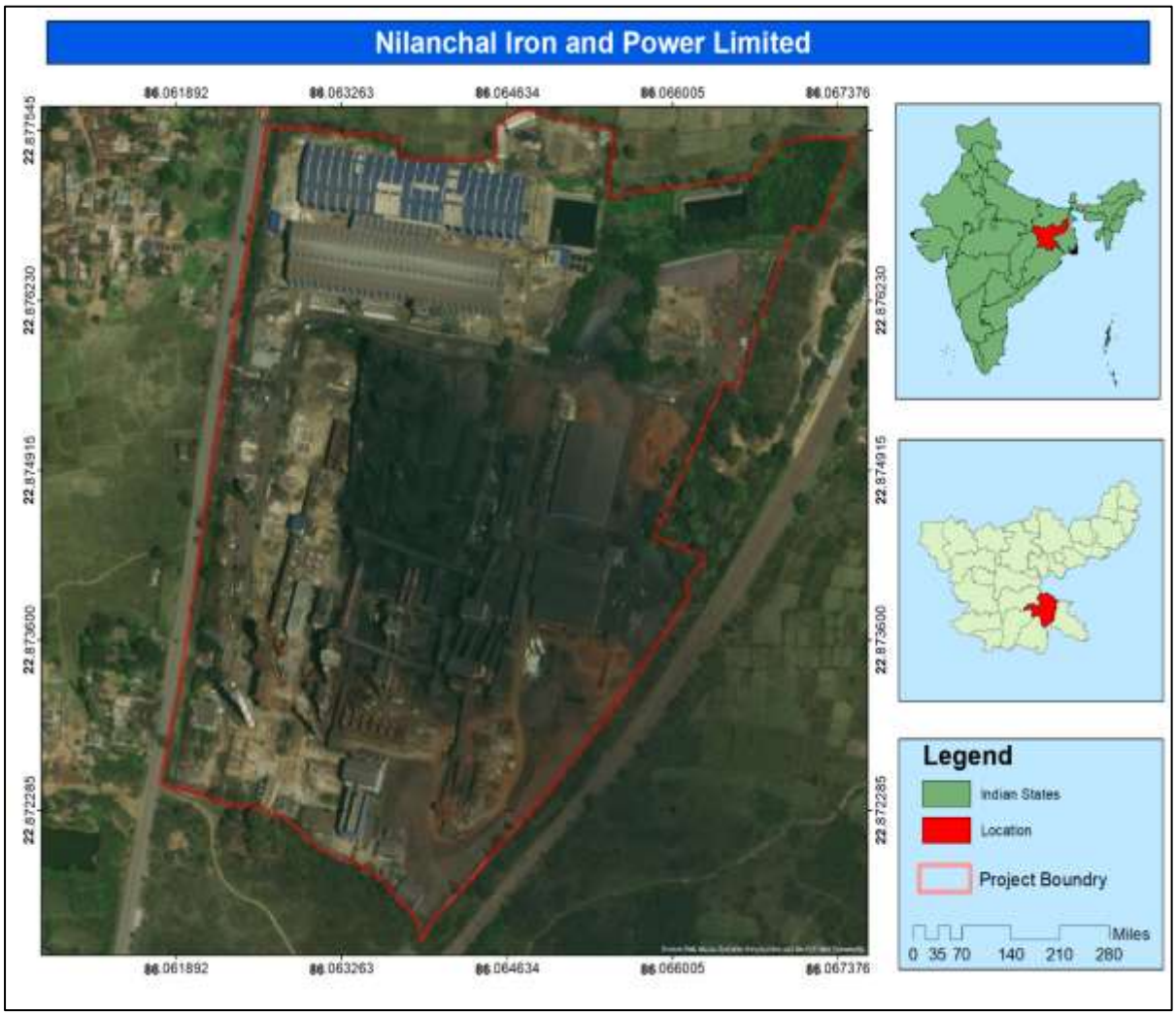
ENVIRONMENTAL COMPLIANCE REPORT

[From Period of April 2022 to September 2022]

Refer MoEF&CC File No. J-11011/662/2008-IA II (I)
Dated 24th December 2009

For

STEEL PLANT



Ratanpur-Kandra Village, Gamharia Block, District Saraikela-Kharsawan, Jharkhand

PROJECT PROPONENTS
M/s Nilachal Iron and Power Limited
5, Bentick Street, Kolkata-700001, West-Bengal

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CIN-U27100WB2002PLC094612

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CERTIFICATE

This is to certify that Environmental Monitoring work has been carried out by Asia Enviro Lab for the period between April to September 2022 for Air, Stack, Fugitive, Noise, Groundwater and Surface Water in reference to your Work Order *Ref. No.-NIPL/PO/2022/04/001 Dated 2nd April 2022.*

ASIA ENVIRO LAB

Authorized Signatory

CHECKED BY

DR. BALWANT KUMAR
Manager, Environment
NILACHAL IRON AND POWER LIMITED

NILACHAL IRON AND POWER LIMITED

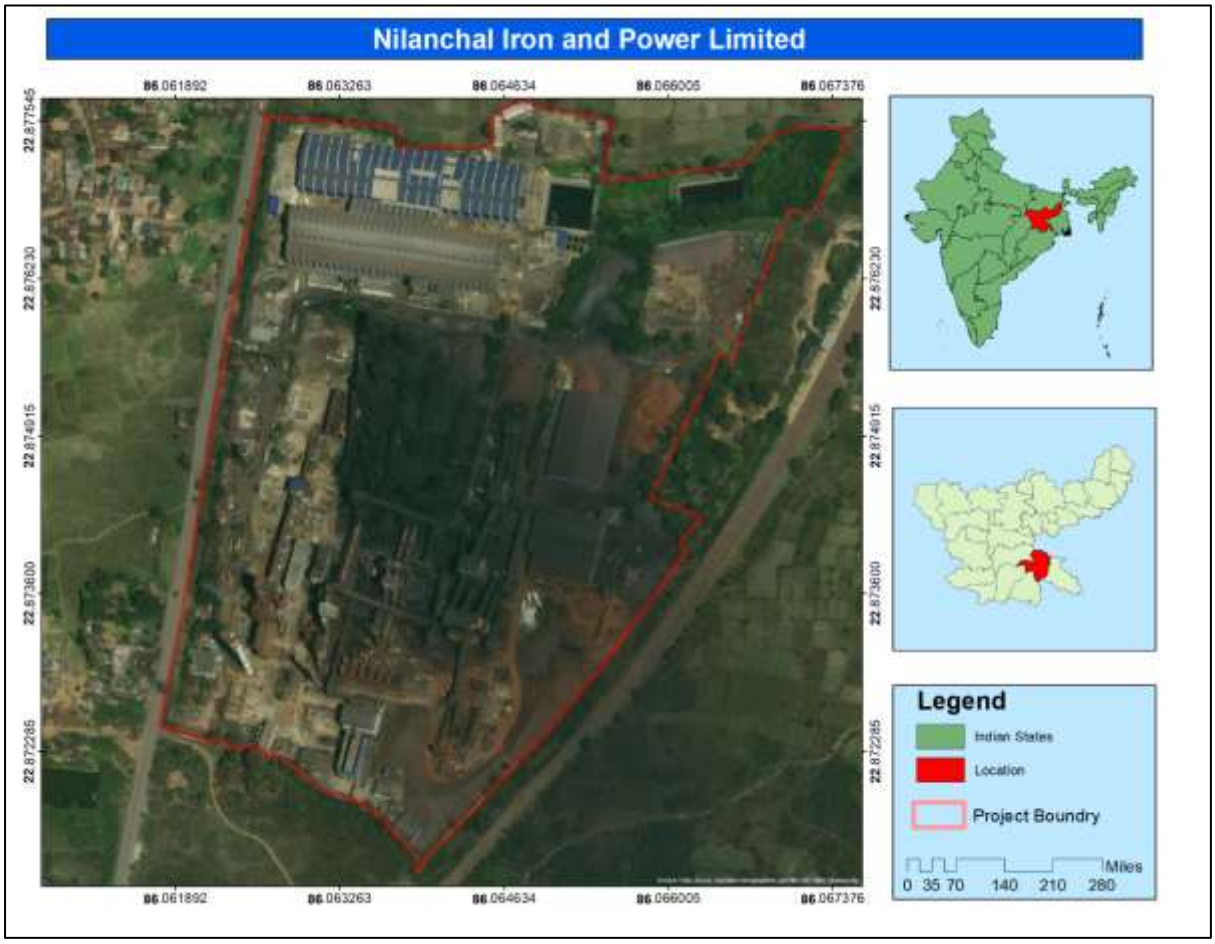
Authorized Signatory

CHAPTER I

1. Introduction

The steel plant is located at Ratanpur-Kandra Village, Gamharia Block, District Saraikela-Kharsawan in the state of Jharkhand. Its geographical co-ordinates are Latitude 22°52'17.31"N to 22°53'8.52"N and longitude 86°03'50.98"E to 86°4'9.66"E with mean sea level as 170 m. (557.7 ft) **Figure 1.1.** The plant has proper road linkage for transport of materials and equipment. Kunki Railway Station of South Eastern Railway is adjacent to the site. The nearest Town is Kandra which is around 2.0 km towards South from project site. Saraikela town (District H.Q) is located at a distance of 25 km from the project site in SW direction. The site is located adjacent to Chandil-Kandra Road and Chowka-Kandra Road. NH-33 and NH-32 are located at distances of 5.06 km and 4.6 km respectively, from the plant. Jamshedpur city is located at a distance of about 16 km from the project site. State capital Ranchi is located at a distance of about 93 km from the project site. The nearest airport is Birsa Munda Airport (Ranchi Airport) which is at a distance of 90 km from the project site. West Bengal Jharkhand state border is at a distance of about 19 km from the project site. Subarnarekha River is flowing at a distance of about 3.5 kms. in North direction w.r.t the plant. Kharkai River is flowing at a distance of about 9.0 kms. in South direction w.r.t the plant.

Figure 1. 1: Location of study area



To facilitate further preparation of environment compliance report for this plant we were taken care of following key objectives which are given below;

(i) Collection of baseline data through sampling, studies, transect walk, experiments, etc.
(ii) Assessing baseline environmental conditions.
(iii) NIPL intends to hire sub consultant for collection of primary data within the study area.

NIPL engaged with Asia Enviro Lab for "Environmental Monitoring for preparation of bi-annual and ecological point of view has been described following chapters: Integration assessment of these environmental commodities gives an overall perception of positive and negative impacts due to industrial & some other human activities process, if any. The study was carried out during **April 2022 to September 2023.** compliance report", with sub-consultancy agreement with respect to Ambient Air, Noise, Water and Soil Monitoring. Based on the above consideration NIPL has developed Environmental Monitoring plan to maintain the requirement of JSPCB and MoEF&CC with respect to management of Ambient Air, Noise, Soil, and Water. The brief discussion of method of sampling and analysis, result interpretation for environmental and ecological point of view has been described following chapters: Integration assessment of these environmental commodities gives an overall perception of positive and negative impacts due to industrial & some other human activities process, if any.

1.1 Environmental Monitoring

The studies carried out during the environmental clearance process had assessed the impacts likely to the physical, ecological and socio-economic environment. Based on this assessment, a management plan to manage the impacts which could not be addressed through the project design. The environmental monitoring program has been devised with the following objectives:

- To evaluate the effectiveness of the proposed mitigation measures and the protection of the ambient environment as per prescribed/ applicable standards for the Project;
- In case of deficiencies in its effectiveness identify the need for improvements in the management plans;
- To verify compliance with statutory and community obligations; and
- To allow comparison against baseline conditions and assess the changes in environmental quality in the Project area.
- The Environment Monitoring Program also lays down the environmental aspects which should be monitored during the different project activities. It also sets out the parameters and frequency of the monitoring.

1.2. Compliance of National Regulations

1.2.1. Regulatory Compliance Standards

For carrying out the Compliance Monitoring and assessing its conformance to the regulation the standard for the Environmental Commodity following specified national and international standard used in this study which are follows;

A. Ambient Air: National Ambient Air Quality Standard (NAAQS, 2009) of the Environment Conservation Rules Ministry of Environment Forest and Climate Change.
B. Fugitive Emission: G.S.R 414(E). 2008 followed by Environmental Protection Act 1986

C. **Ambient Noise:** Ambient Air Quality Standards in respect of Noise adopted by Ministry of Environment Forest and Climate Change, 2009.
D. **Groundwater:** Indian Standard Specifications for Drinking Water. IS: 10500, regulation 2012 for essential characteristics of drinking water.
E. **Surface water:** Indian Standard Specifications for Surface Water Quality Standards (as per IS: 2296) based on the, Class A to Class E categories.
F. **Waste Water:** Environmental Protection Act 1986, Schedule VI; General Standards for Discharge of Environmental Pollutants Part-A: Effluents
G. **Soil Quality:** There are no such national standard for soil quality. Therefore, Dutch Standard: Dutch Target and Intervention Values, 2000, for soil and sediment and National Environment (Minimum Standards for Management of Soil Quality) Regulations, Uganda 2001 (S.I. No. 59 of 2001) have been used for this study.

1.3. Environmental Monitoring Requirements and Parameters

1.3.1. Site Description and Sampling Location

For locating sampling points, preliminary reconnaissance survey covering the entire study area has been carried out before the sampling. During reconnaissance survey, all necessary investigation has been carried out including existing drainage pattern, land elevation, land use pattern of the location and physiographical condition were taken into consideration. In the first step, preliminary investigation was carried out to assemble as much of the general, or background information and identified gaps, and map out the strategies for collecting the missing data.

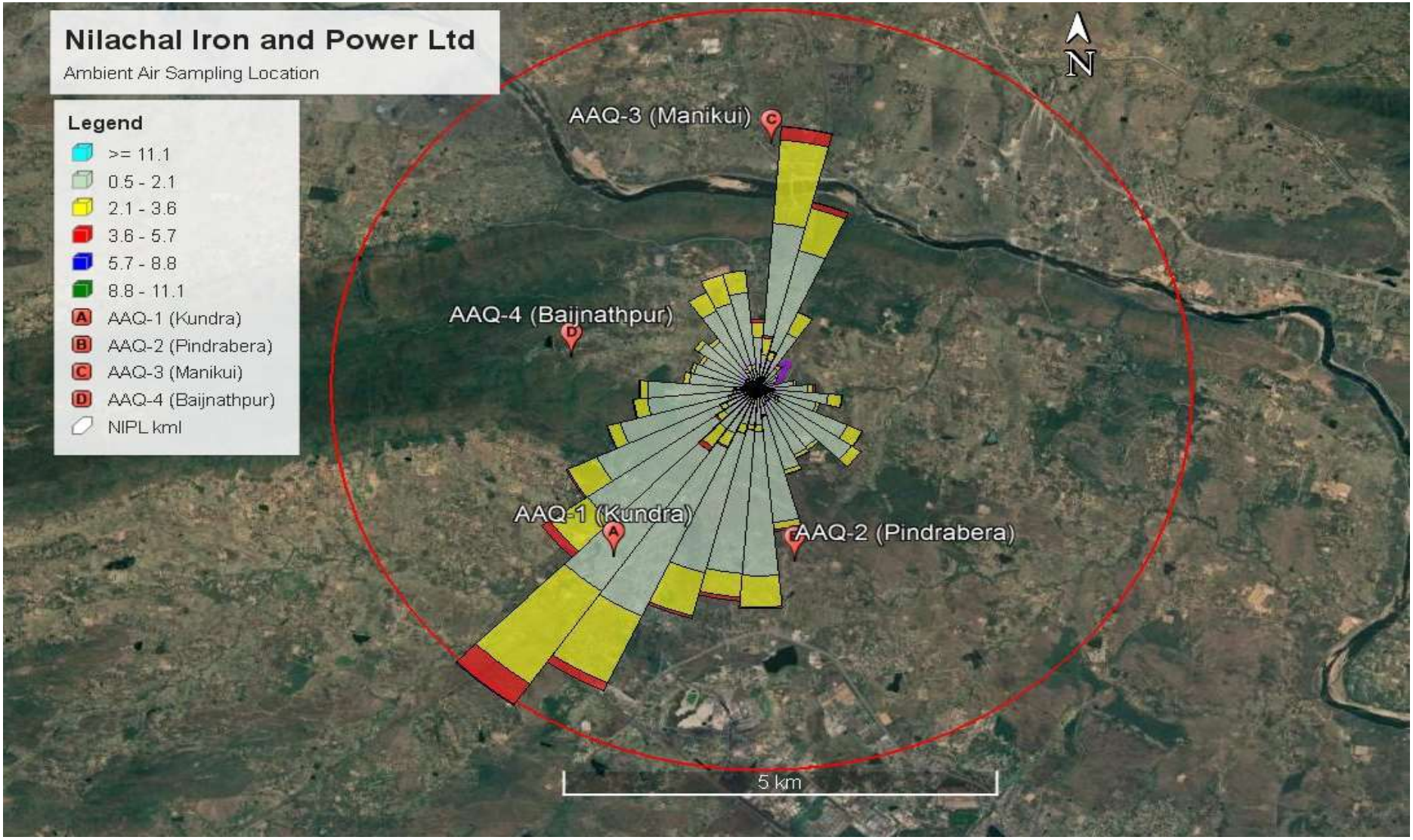
1.3.2. Ambient Air Sampling and analysis

The ambient sampling location has been carried out based on the background of the area with keep in mind of point source and other interference. Additionally, height of the sampling point has been considered based on the presence of wall and other obstruction. The selection of sampling site has been chosen based on the free-flowing air, wind direction and well mixed air. The elevation angel of nearby buildings and other obstruction has been considered during site selection. All steps have been carried under consideration of Standard Guideline for Ambient Air Quality Monitoring Program. Four location (n=04) was monitored 24 hrs by manually for ambient air quality estimation in the month of April 2022 to September 2022, which details are given in the **Table 1.1 and Figure 1.2**

Table 1. 1: Details of Ambient air monitoring location & their geographical coordinates

Ambient Air Monitoring Locations					
Monitoring Location	**Location Code**	**Distance/ Direction**	**Latitude (deg., min, sec.)**	**Longitude (deg., min, sec.)**	**Class as per CPCB Guideline NAAQS, 2009**
Kundra	**AAQ-1**	**SW at 2.75 Km from Plant**	**22°51'16.66"N**	**86° 2'51.24"E**	**Commercial**
Pindrabera	**AAQ-2**	**SE at 2.30 Km from Plant**	**22°51'14.50"N**	**86° 4'4.80"E**	**Residential**
Manikui	**AAQ-3**	**N at 3.50 Km from Plant**	**22°54'12.67"N**	**86° 3'56.02"E**	**Residential**
Baijnathpur	**AAQ-4**	**W at 2.30 Km from Plant**	**22°52'41.40"N**	**86° 2'33.88"E**	**Silent**

Figure 1.2: Ambient Air sampling location



1.3.3. Fugitive Emission Sampling

For the estimation of fugitive emission sources were identified in the steel manufacturing plants through collection of preliminary information through questionnaire, survey and observation. The various indicative areas like storage areas or raw material and finished products, coal, processing dust etc, transfer operation, loading and unloading operations, vehicular movements on paved roads etc) were targeted to identify the potential source of emission. Based on the survey and nature of wark zone four important location were targeted for fugitive emission sampling which geographical details area given in the **Table 1.2 and Figure 1.3.**

Table 1.2: Details of Fugitive emission monitoring location

Monitoring Location	Location Code	Distance/ Direction	Latitude (deg., min, sec.)	Longitude (deg., min, sec.)
Coal Yard Area	**FEQ-1**	**10 m from source**	**22°51'16.66"N**	**86° 2'51.24"E**
Power Plant	**FEQ-2**	**10 m from source**	**22°51'14.50"N**	**86° 4'4.80"E**
Gate No 3	**FEQ-3**	**10 m from source**	**22°54'12.67"N**	**86° 3'56.02"E**
DRI	**FEQ-4**	**10 m from source**	**22°52'41.40"N**	**86° 2'33.88"E**

Figure 1.3: Fugitive Emission Sampling Location

A well-designed monitoring program was carried out to assess the status of ambient air quality in the project area. The parameters studied were Particulate Matter (PM_{10}& $PM_{2.5}$), Sulphur Dioxide (SO_2), Nitrogen Dioxides (NO_2), Carbon monoxide (CO), and VOC. The 24 hrs monitoring have been carried out to covering above mentioned parameters. The monitoring was done by using Respirable Dust Sampler (RDS) and Fine Dust Sampler (FDS). The objective was to assess the existing level of air pollutants. In regard to the techniques for

collection of samples of particulate matter (PM_{10}& $PM_{2.5}$) the "Respirable Dust Sampler (RDS) Envirotech Model APM 860 and "Fine Dust Sampler (FDS)" Envirotech Model APM 154 were used for air monitoring.

The dust particulate matter was collected on filter paper (size GF/A20.3x25.4 cm) and the gaseous pollutants were collected simultaneously by a known volume of air through a number of bubblers of different flow rate through appropriate solution for absorbing different gases. The principle involved in Particulate Matter (PM) sampling method is that the particles are filtered from known volume of an air sample by a suction apparatus and the particle are deposited on a filter paper. Generally the gaseous pollutants in air are made to react with liquid absorbing media at atmospheric temperature and pressure when air is bubbled through the absorbing solution in the impinger. The analyzed results for different pollutants were compared as prescribed by NAAQS (2009) which details given in **Table 1.3.**

Table 1. 3: Seventh Amendment Rules, 2009, National Ambient Air Quality Standards

Sl. No.	Pollutants	Time Weighted Average	Concentration in Ambient Air		Methods of Measurement
			Industrial, Residential, Rural & Other Areas	Ecologically Sensitive Area	
1.	Sulphur Dioxide (SO2), µg/m3	Annual*	50	20	-Improved West & Gaeke
		24-hours**	80	80	-Ultravoilet Fluorescence
2.	Nitrogen Dioxide (NO2), µg/m3	Annual*	40	30	-Modified Jacob & Hochheiser
		24-hours**	80	80	-Chemiluminescence
3.	Particulate Matter PM10, µg/m3	Annual*	60	60	-Gravimetric -TOEM
		24-hours**	100	100	-Beta attenuation
4.	Particulate Matter PM2.5 µg/m3	Annual*	40	40	-Gravimetric-TOEM
		24-hours**	60	60	-Beta attenuation
5.	Carbon Monoxide (CO), mg/m3	8-hours*	02	02	-NDIR Spectroscopy
		1-hour**	04	04	
6.	Ozone (O3) µg/m	8-hours*	100	100	UV Photometric
		1-hour**	180	180	
7.	Lead (Pb) µg/m3	Annual*	0.5	0.5	ASS / ICP method
		24-hours**	1.0	1.0	
8.	Ammonia (NH3) µg/m3	Annual*	100	100	Indophenol blue method
		24-hours**	400	400	
9.	Benzene (C6H6) µg/m	Annual*	5	5	Gas chromatography
10	Benzo (a) Pyrene (BaP) –ng/m3	Annual*	1	1	Gas chromatography
11.	Arsenic (As) ng/m3	Annual*	6	6	ASS / ICP method
12.	Nickel (Ni) ng/m	Annual*	20	20	ASS / ICP method

A. Particulate Matter (PM_{10})

The sampling of ambient air for evaluating PM_{10} levels were performed with a RDS Sampler fitted with a cyclone separator. Air exiting the separator is drawn at a measured rate through pre-weighed glass fiber filter sheets of 20 cm x 25 cm sizes. The concentration of PM_{10} were

computed from the average air flow rate, sampling period and the mass of particulate matter collected over the filter surface.

[PM_{10} ($\mu g/m^3$) = (Final weight of filter paper– initial weight of filter paper) / volume of air]

B. Particulate Matter ($PM_{2.5}$)

$PM_{2.5}$ is determined as per USEPA (United State Environment Protection Agency) guidelines with the help of Fine Dust Sampler (FDS). Ambient air with an average flow rate of 16.67 LPM is allowed to pass through Louvered inlet and WINS Impactor assembly having a 37mm dia. filter paper. Particulate matter of size <2.5 microns is deposited on 46.2mm dia. PTFE filter. The difference of final weight and initial weight of filter paper gives the weight of particulate matter of size <2.5 microns. The concentration of $PM_{2.5}$ is computed as the weight of dust deposited on the filter divided by volume of air sampled.

[$PM_{2.5}$ ($\mu g/m^3$) = (Final weight of filter paper– initial weight of filter paper) / volume of air]

C. Sulphur Dioxide (SO_2)

The sampling of ambient air for evaluating the gaseous pollutants were performed with a Multigas Sampler, using the vacuum created by the FDS Sampler for drawing the air samples through the impingers. For SO_2, air was drawn at a measured and controlled rate of 400 to 500 ml/min & passed through a solution of potassium tetrachloromercurate (TCM). After sampling, the absorbing reagent was treated with dilute solutions of sulfamic acid, formaldehyde and para-rosaniline hydrochloride. The absorbance of the intensely coloured para-rosaniline methyl sulphonic acid was measured at the wavelength of 560 nm using spectrophotometer and the amount of SO_2 in the sample was computed. The ambient SO_2 concentrations were computed from the amount of SO_2 collected and the volume of air sampled.

$$[SO_2\ (\mu g/m^3) = (A - A_0) \times 1000 \times B \times D/\ V]$$

Where, A = Sample Absorbance, A_0 = Reagent blank Absorbance, B = Calibration factor (µg/absorbance), D = Volume of absorbance solution in impinger during monitoring / volume of absorbing solution taken for analysis and V = Volume of Air Sample in liters.

D. Oxides of Nitrogen

Air was drawn at a measured and controlled rate of about 200 ml/minute through an orifice-tipped impinger containing solutions of sodium hydroxide and sodium arsenite. After completion of the sampling, an aliquot of the used absorbing solution was treated with solutions of H_2O_2, sulphanilamide and NEDA. The nitrite ion present in the impinger was calculated from the absorbance of the resulting solution measured at 540 nm using spectrophotometer. The ambient NOx concentrations were computed from the total nitrite ion present in the impingers, overall efficiency of the impinger and the procedure, and the volume of air sampled.

$$[NO_x\ (\mu g/m^3) = (A - A_0) \times 1000 \times B\ \times D/\ 0.82V]$$

Where, A = Sample Absorbance, A_0 = Reagent blank Absorbance, B = Calibration factor (µg/absorbance), D = Volume of absorbance solution in impinger during monitoring / volume of absorbing solution taken for analysis and V = Volume of Air Sample in liters.

E. Carbon Monoxide

Rubber Bladder and Aspirators have been used to collect the 8 hourly samples for carbon monoxide. The CO levels were analysed through NDIR Spectroscopy method.

1.3.4. Ambient Noise Level

During the construction or any machinery activities induce noise level in the ambient environment e.g. heavy earth, shipyard, moving machinery, compressors, welding machine, small generators and other activities. In addition, there would be movement of vehicles for construction activities which would also add to the noise levels. Noise monitoring was carried out at four locations and the noise levels were monitored using a hand hold instrument. The noise level was measured for four locations (n=04) by sound level meter LUTRON, SL-4001-Q627552 & LUTRON, SL-4033-Q638688 (digital Instrument) which details has been incorporated in **Table 1.4 and Figure 1.4.**

Table 1.4: Noise Monitoring Location

Ambient Nosie Monitoring Locations					
Monitoring Location	**Location Code**	**Distance/ Direction**	**Latitude (deg., min, sec.)**	**Longitude (deg., min, sec.)**	**Class as per CPCB Guideline NAAQS, 2009**
Kundra	**ANQ-1**	**SW at 2.75 Km from Plant**	**22°51'16.66"N**	**86° 2'51.24"E**	**Commercial**
Pindrabera	**ANQ-2**	**SE at 2.30 Km from Plant**	**22°51'14.50"N**	**86° 4'4.80"E**	**Residential**
Manikui	**ANQ-3**	**N at 3.50 Km from Plant**	**22°54'12.67"N**	**86° 3'56.02"E**	**Residential**
Baijnathpur	**ANQ-4**	**W at 2.30 Km from Plant**	**22°52'41.40"N**	**86° 2'33.88"E**	**Silent**

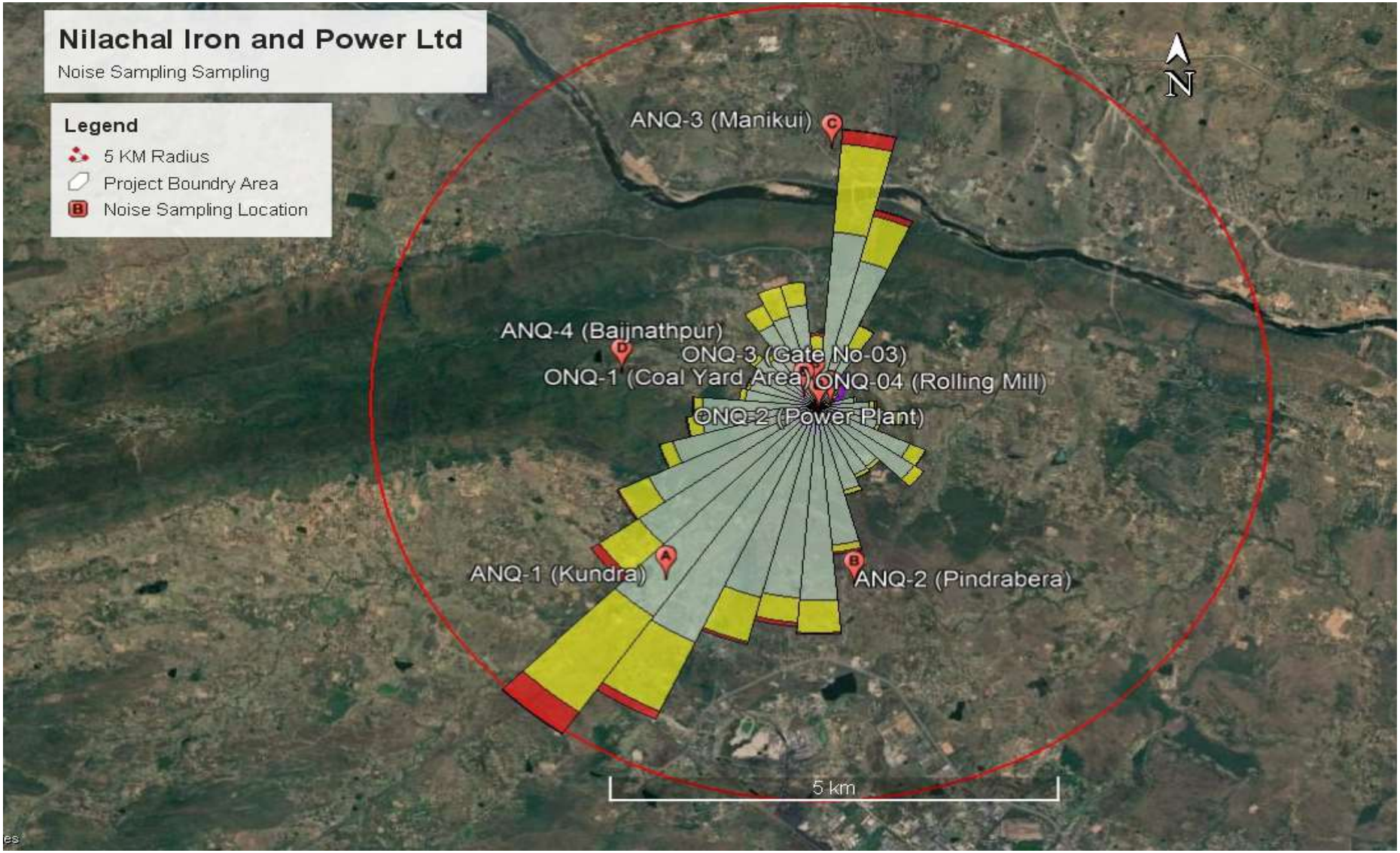
Furthermore, for detailed study of the occupational noise level distribution at plant, different compartments were studied which details are given in the **Table 1.5** and **Figure 1.4** for noise management and noise safety at work zone to daily consideration during working time in this area.

Table 1.5: Occupational noise monitoring location with their geographical coordinates

Monitoring Location	**Location Code**	**Distance/ Direction**	**Latitude (deg., min, sec.)**	**Longitude (deg., min, sec.)**
Coal Yard Area	**ONQ-1**	**10 m from source**	**22°51'16.66"N**	**86° 2'51.24"E**
Power Plant	**ONQ-2**	**10 m from source**	**22°51'14.50"N**	**86° 4'4.80"E**
Gate No 3	**ONQ-3**	**10 m from source**	**22°54'12.67"N**	**86° 3'56.02"E**
Rolling Mill	**ONQ-4**	**10 m from source**	**22°52'41.40"N**	**86° 2'33.88"E**

The calibrated and charged sound level meter is adjusted for slow time response. The noise level was measured at different sites for 24 hrs continuously and maximum and minimum level of noise was recorded for the particular site and then average was calculated which gave the final readings. Readings were taken in each division of north, south, east and west around each source and at various distances and the maximum minimum for particular hours were recorded.

Figure 1.4: Images of Noise monitoring location



A. The Sensor or Microphone

The sensor is a high precision electrode condenser microphone, which must be protected from physical abuse, dirt, oil, water or ingress of any such substance.

B. The Range Selector

These switches can be used for selecting the relevant range of the sound level.

C. Methodology

The calibrated and charged sound level meter is adjusted for slow time response. The noise level was measured at different sites for 24 hrs continuously and maximum and minimum level of noise was recorded for the particular site and then average was calculated which gave the final readings. Readings were taken in each division of north, south, east and west around each source and at various distances and the maximum minimum for particular hours were recorded. The obtained result of the noise will be compared with the Standards for Noise, adopted by MoEF&CC, 2009 which details are given the **Table 1.6.**

Table 1.6: Indian Standards for Noise adopted by MoEFCC

Location Category	Standards determined at dB(A) Leq unit	
Time Interval (24 Hr)	Day	Night
Industrial	75	70
Commercial	65	55
Residential	55	45
Silence zone	50	40

*Daytime is reckoned in between 6 A.M and 10 P.M.
*Night-time is reckoned in between 10 P.M. and 6 A.M.

1.3.5. Water Sampling and analysis

Reviewing the projected area and background information reading water, sediment and soil characteristics, and choose suitable analytical and sampling techniques for testing under prevailing geographical conditions. Evaluate the details scope of study which includes physicochemical parameters, biochemical parameters, Major ions, metals, metalloids and other essential micro-nutrients in water soil and sediment commodity. Planning for Execution including identification for manpower, checking of Instrument for Sampling, move to field with all instruments and identify the field location as per schedule. Collecting the necessary secondary data to identify regional geology, population, climatic condition for populating the chosen techniques. Following techniques will be used during sampling which are given below;

- Initially, water, samples will be taken from projected location as per given by customer based on the sampling method as suggested by American Public Health Association (APHA) and United State Environmental Protection Agency (USEPA) respectively.
- The physical parameters will be measured at the sampling site itself since these are very sensitive to change after sampling.
- Appropriate collection of samples and mixing of the composite sample and its proper preservation, labeling and storage will be carried out carefully during sampling time.
- To avoid mixing of samples and for accurate record keeping, a label with date time, name of sampling point and their coordinates has been attached to each sample bag during sampling time.
- All collected water samples were transported in laboratory after preservation as per standard procedures described by APHA.

Sufficient quantity of water samples was filtered and acidified by adding 2-3 drops of HNO3 for preservation for further heavy metals analysis in laboratory. Five Surface water (n=05) and five (n=05) groundwater sampling sites have been chosen for the investigation based on the physiographical condition **Figure 1.5.** The selection of sites was done considering the location of different project components, junction of streams course, spots of high-water velocity and some of the stagnated pools along with the areas having human interference. Both sites were targeted based on availability of human activities. The details of the sampling sites for Surface water and groundwater with their geographical coordinates are shown in the **Table 1.7** and **Figure 1.5.**

Table 1. 7: Geographical details of water quality monitoring location

Monitoring Location	Location Code	Distance/ Direction	Latitude (deg., min, sec.)	Longitude (deg., min, sec.)
Subarnarekha River (Upstream)	SW-1	N at 3.50 km from Plant	22°53'52.63"N	86° 3'59.84"E
Subarnarekha River (Downstream)	SW-2	6 km from Plant	22°53'6.04"N	86° 6'38.17"E
RHW Pond	SW-3	within Plant	22°52'36.85"N	86° 3'58.89"E
Raghunathpur Village Pond	SW-4	300-meter form Plant	22°52'28.73"N	86° 3'32.59"E
Kandra Village Pond	SW-5	350-meter from plant	22°52'15.30"N	86° 3'31.89"E
Admin building Drinking water	GW-1	within Plant	22°52'22.82"N	86° 3'43.56"E
Worker Shed Drinking water	GW-2	within Plant	22°52'39.02"N	86° 3'52.69"E
Raghunathpur Village groundwater	GW-3	450-meter from plant	22°52'35.49"N	86° 3'29.69"E
Kandra Village Groundwater	GW-4	300-meter from plant	22°52'20.34"N	86° 3'32.10"E
Raimara Village Groundwater	GW-5	850-meter from plant	22°51'53.55"N	86° 4'7.57"E

The study includes the various baseline parameters of water quality. Integration of water quality parameters give an overall perception of positive and negative impacts due to agriculture, industrial and some other human activities, if any. The collection of samples for water sample, different methods and techniques were applied separately based on the international standards method like American Public Health Association (APHA, 2005). Samples for chemical analysis were collected in polyethylene containers. Samples collected for metal content were acidified with 1 ml. HNO_3. Samples for bacteriological analysis were collected in sterilized glass bottles. Selected physico-chemical parameters have been analyzed at site laboratory for projecting the status of existing water quality Data on existing aquatic environmental conditions in and around proposed project has been generated as per Biological characteristics of water. Since River and Pond water is primarily considers as surface water, so, surface water standards suggested by Indian Standard *Specifications for* Surface Water Quality Standards (as per IS: 2296) based on the, Class A to Class E categories was used in this study **Table 1.8.** Similarly, for the groundwater, Indian Standard *Specifications* for Drinking Water. *IS: 10500, regulation 2012 for* essential characteristics of drinking water was used in this study **Table 1.9.**

Figure 1.5: Groundwater & Surface Water Monitoring Location

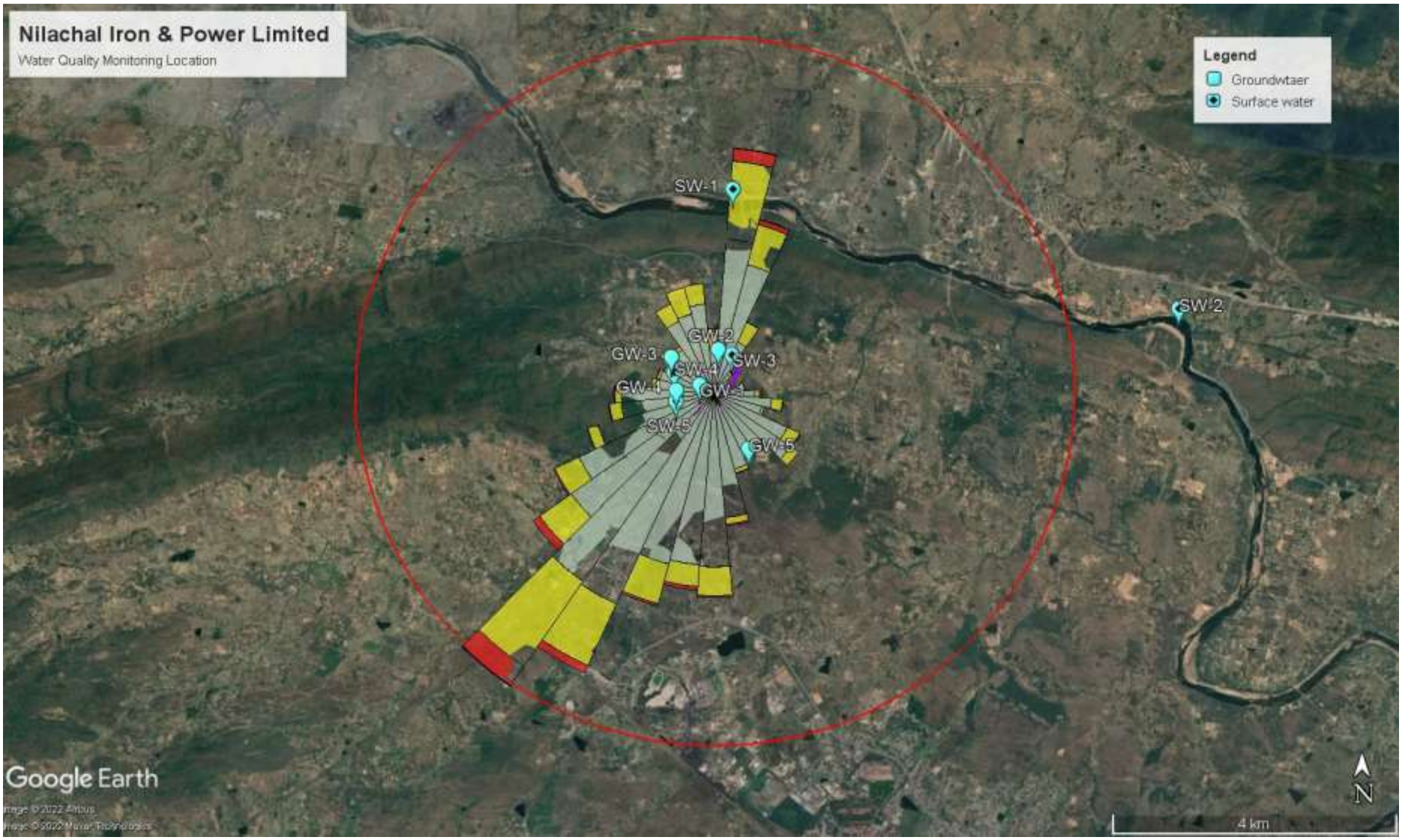


Table 1.8: Surface water quality criteria based on the IS: 2296

S.N	List of Parameters	Class-A	Class-B	Class-C	Class-D	Class-E	Method of Estimation
I	**Physicochemical Parameters**						
1	Colour	10	300	300			APHA (23rd Edition) 2120B 2017
2	pH value	8.5	8.5	8.5	8.5	8.5	APHA(23rd Edition) 4500-H-B
3	Conductivity	-	-	-	1000	2250	APHA (23rd Edition) 2510B
4	Total Dissolved Solids (as TDS)	500	-	1500		2100	
5	DO	6	5	4	4	-	APHA 22nd Edtn 2012, 4500-O-C
II	**Chemical Parameters**						
6	Chloride (as Cl)	250	-	600	-	600	APHA (23rd Edition)4500-Cl B 2017
7	Fluoride (as F)	1.5	1.5	1.5	-	-	APHA (23rd Edition)4500 - F C/D, 2017
8	Iron (as Fe)	0.3	-	50	-	-	APHA (23rd Edition)3500 Fe B 2017
9	Nitrate (as NO3)	20		50	-	-	APHA (23rd Edition) 4500- NO3-E, 2017
10	Sulphate (as SO4)	400	-	400	-	1000	APHA (23rd Edition) 4500-SO4 E 2017
11	Lead (as Pb)	0.1	-	0.1	-	-	APHA (23rd Edition)3120B 2017
12	Arsenic(as As)	0.05	0.2	0.2	-	-	APHA (23rd Edition)3120B 2017)
13	Biochemical Oxygen Demand (as BOD)	2	3	3	-	-	APHA (23rd Edition) 5210B 2017
14	Chemical Oxygen Demand (COD)	-	-	-	-	-	APHA (23rd Edition) 5220B, 2017
15	Oil and Grease	-	-	0.1	0.1		APHA (23rd Edition) 5220B, 2017

Source: *Surface Water Quality Standards (as per IS: 2296) based on the, Class A to Class E*

Table 1.9: Groundwater quality standard based on the IS: 10500, regulation 2012

S.N	List of Parameter	Desirable limit	Permissible limit	Method of Estimation
1	pH value	6.5-8.5	6.5-8.5	APHA(23rd Edition) 4500-H-B
2	Electrical conductivity	---	---	APHA (23rd Edition) 2510B
3	Total Dissolved Solids (as TDS)	500	2000	APHA 23ND EDITION, 2540 C
4	Chloride (as Cl)	250	1000	APHA (23rd Edition)4500-Cl B 2017
5	Fluoride (as F)	1	1.5	APHA (23rd Edition)4500 - F C/D, 2017
6	Nitrate (as NO3)	45	45	APHA (23rd Edition) 4500- NO3-E, 2017
7	Sulphate (as SO4)	200	400	APHA (23rd Edition) 4500-SO4 E 2017
8	Total Hardness (as CaCO3)	200	600	APHA (23rd Edition) 2340 C 2017
9	Total Iron (as Fe)	---	0.3	APHA 22nd Edtn-2012, 2540E
10	Copper (as Cu)	0.05	1.5	APHA (23rd Edition)3120B 2017 (ICP OES)
11	Cadmium (as Cd)	0.003	0.003	APHA (23rd Edition)3120B 2017
12	Lead (as Pb)	0.01	0.01	APHA (23rd Edition)3120B 2017
13	Mercury (as Hg)	0.001	0.001	IS 3025(Part 48)-1994; Rffm:2014
14	Total Chromium (as Cr)	0.05	0.05	APHA (23rd Edition)3111 D 2017 (AAS Flame)
15	Arsenic(as As)	0.01	0.05	APHA (23rd Edition)3120B 2017 (ICP OES)

Source: *Indian Standard* Specifications *for Drinking Water*. IS: 10500, regulation 2012 for *essential characteristics of drinking water.*

1.3.6 STP effluent discharge outlet water quality

To maintain the environmental and ecological condition, Nilach Iron and Power Limited Site has installed the sewage treatment plant in the ship for waste water treatment based on the national and international regulatory standard. The aim of the treatment plant to reduce the contaminants of all wastes which generated by daily anthropogenic activities on the ship based on the recommended standard. In this system, physical, chemical and biological process is used to remove the contaminants to produce treated effluent that should be safe enough for release into the environment. Mechanically, all sewage collected into the collection tank with certain retention time after then all waste bypass into bio-accumulation tank to breakdown the organic wastes from the effluent. Furthermore, after over the retention period again bio treated effluent transfer in the chemical dosing tank to destroy the

bacteriological colonies. The final treated affluent discharge into the water bodies. The flow diagram of the treatment plant is given **Figure 1.6.**

Since the waste water is reuse into the plant after treating through sewage treatment plant. Therefore, it is necessary to evaluate the quality of treated effluents before use it into the plant. In this study, based on the above consideration the standard for key parameters like Temperature, TSS, Chloride, pH, BOD5, COD, Oil and Grease, Phenols, Sulphide, Heavy Metals, Total Coliform has been compared by Environment Protection Act (EPA, 2002), General Notice No.44.of 2003, regulation 4. The standard limits for the selected parameters are listed into the below **Table 1.10.**

Figure 1. 6: Systematic Diagram of Sewage Treatment Plant

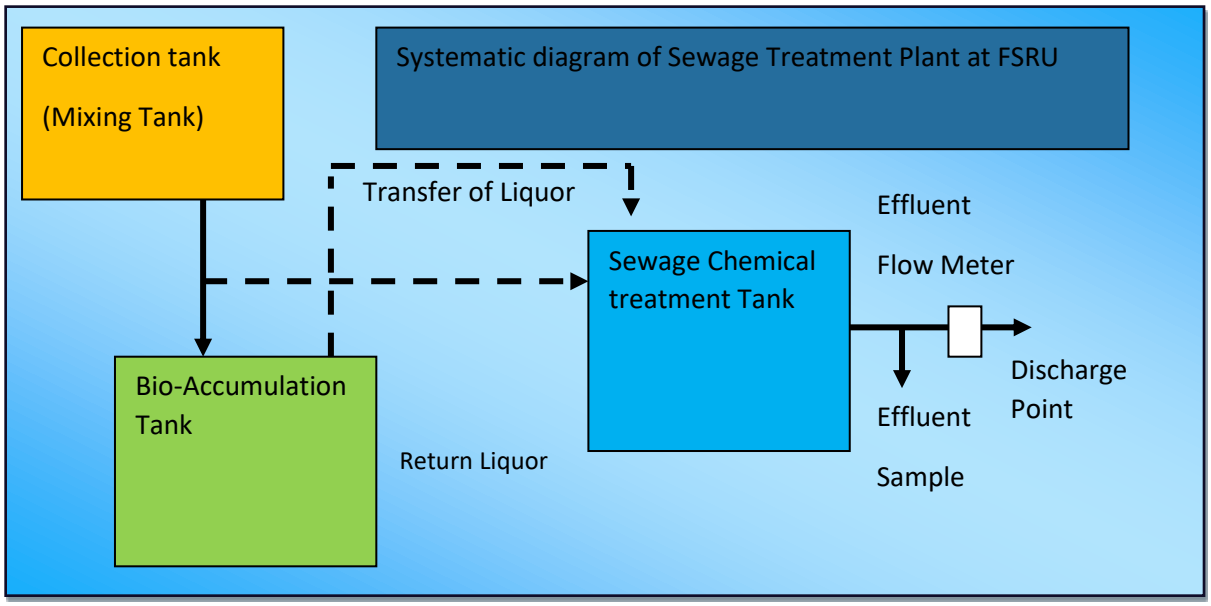


Table 1.10: Standard limits for the selected parameters and their method of analysis

Parameters	Unit	EPA	Method
Temperature		400	APHA(23rd Edition)
Potential of Hydrogen	None	6-8.5	IS 2720 (Part 26)-1987;Rffm:2011
Total Suspended Solid (as TSS)	mg/l	100	APHA(23rd Edition)2540D
Phenol	mg/l	1	APHA(23rd Edition)
Cyanide	mg/l	0.2	APHA(23rd Edition)
Biochemical Oxygen Demand	mg/l	30	APHA (23rd Edition) 5210B 2017
Chemical Oxygen Demand	mg/l	250	APHA (23rd Edition) 5220B, 2017

Environment Protection Act (EPA, 2002), General Notice No.44.of 2003, regulation 4.

For the treated waste water sampling the, sterilized bottles were used based the physical, chemical and biological parameters followed by international standards method like American Public Health Association (APHA, 2005). Waste water quality sampling was carried out at one outlet at the plant through which the effluent water is disposed of to assess for the future effects on the quality of the marine water. The parameters monitored, rational for selection of the sampling is presented in **Table 1.11.**

Table 1.11: Geographical details of waste water quality monitoring location

Monitoring Location	Location Code	Distance/ Direction	Latitude (deg., min, sec.)	Longitude (deg., min, sec.)
STP-Outlet	**WW-1**	**Within Plant**	**22°52'28.74"N**	**86° 3'51.99"E**

1.3.7. Storm-Water Drainage Quality

There is daily routine for the floor wash at plant in contest of better hygiene Management. In this process water might get interact with dirt, emulsified oil or any organic compound from the surface washed area. Similarly, rainwater that flows over outside surfaces of the shed is directly drained into storm-water drains. Therefore, for better understating we have collected the wash water for estimation of oil & Grease and to find out the status of water quality before discharge in the fresh water bodies **Table 1.12.**

Table 1. 12: Strom Water Drainage Quality

Monitoring Location	Location Code	Distance/ Direction	Latitude (deg., min, sec.)	Longitude (deg., min, sec.)
Wash water from the drain	**SWD-1**	**Within Plant**	**22°52'28.74"N**	**86° 3'51.99"E**

1.3.8 Soil Quality

Considering the topography, slope, vegetation, land type, drainage condition and soil colour suitable sampling technique was applied in each site.

- For dry or moist soil, sampling was done by either using auger or opens a V-shaped pit in the topsoil by using spade.
- Topsoil sample was collected at 15 -20 cm depths from the surface. In case of plough pan soil sample was collected at 10-15 cm depth from surface.
- Each location 5 to 10 simple sample was collected. Then the entire sample of each site was mixed thoroughly in a plastic sheet to have a composite sample. Then remove the grasses, roots, stubbles or nodules etc properly.
- For moist soil sample, the simple samples of each site were put together levelling with suitable ID number and information and bring to the laboratory for air drying at room temperature.
- For the sampling, 1 Kg cleaned polyethylene bags for soil were used and transferred to laboratory as per United States Environmental Protection Agency (US EPA, 1992) guidelines.
- To avoid mixing of samples and for accurate record keeping, a label with date time, name of sampling point and their coordinates has been attached to each sample bag during sampling time.

The construction of the pipeline and the other mechanical activities shall result in disturbance of the soil. The disturbance would be temporary in nature but can high in waste material handling area. To assess the impacts the soil from waste material area and outside plant analysed at two locations which are presented in **Table 1.13**

Table 1. 13: Geographical details of soil quality monitoring location

Monitoring Location	Location Code	Distance/ Direction	Latitude (deg., min, sec.)	Longitude (deg., min, sec.)
Soil From outside plant	**SQ-1**	**Outside plant**	**22°52'28.03"N**	**86° 3'38.50"E**
Soil From Waste material handling Area	**SQ2**	**Within Plant**	**22°52'31.73"N**	**86° 3'49.37"E**

There is no such national standard for soil quality. Therefore, *Dutch Standard: Dutch Target and Intervention Values, 2000, for soil and sediment*

2. Result & Discussion

2.1 Air quality

2.2.1 Ambient Air Quality

In this study, for the estimation of particulate load of PM_{10}, $PM_{2.5}$ and gaseous compound like SOx, NOx, CO, O_3, Metals and Hydro Carbon were studied in view of understand the baseline concentration of air quality to establish the management plan against this project. For this, eleven sites were chosen based on the land use characteristic of the area under consideration of industrial, commercial residential and mixed zone area to gather the voluminous air quality into information for the proposed project. Analysed result of the monitored site have been tabulated with descriptive analysis and incorporated in the **Table 2.1**

Table 2.1: Ambient Air Quality of the study area

S.N	Date of Sampling	PM_{10}	$PM_{2.5}$	SOx	NOx	O_3	NH3	Pb	As	Ni	C2H6	BAP	CO
	Unit	µg/m³											mg/m³
AAQ-1	23.04.2022	93.4	57.7	15.1	34.4	27.6	11.3	ND	ND	ND	ND	ND	0.85
	20.05.2022	90.54	56.7	14.1	32.8	26.8	12.3	ND	ND	ND	ND	ND	0.86
	21.06.2022	91.55	56.1	13.7	31.8	26.4	12.1	ND	ND	ND	ND	ND	0.88
	18.07.2022	89.13	55.7	12.6	29.5	24.3	13.1	ND	ND	ND	ND	ND	0.76
	22.08.2022	88.12	50.6	10.4	23.5	24.5	10.1	ND	ND	ND	ND	ND	0.88
	23.09.2022	87.13	48.4	12.2	19.5	21.5	11.8	ND	ND	ND	ND	ND	0.89
AAQ-2	23.04.2022	94.78	53.6	16.1	35.4	27.7	12.7	ND	ND	ND	ND	ND	0.76
	20.05.2022	95.81	55.4	15.3	31.3	27.8	11.5	ND	ND	ND	ND	ND	0.75
	21.06.2022	97.82	55.2	14.2	34.2	26.9	12.3	ND	ND	ND	ND	ND	0.85
	18.07.2022	96.21	54.1	13.9	32.1	27.6	11.1	ND	ND	ND	ND	ND	0.71
	22.08.2022	94.21	51.1	11.9	29.1	25.6	10.1	ND	ND	ND	ND	ND	0.98
	23.09.2022	91.20	49.1	10.9	28.1	22.6	11.1	ND	ND	ND	ND	ND	1.08
AAQ-3	23.04.2022	90.54	47.4	12.1	33.3	26.4	11.6	ND	ND	ND	ND	ND	0.86
	20.05.2022	89.42	46.5	12.6	34.2	26.2	13.1	ND	ND	ND	ND	ND	0.82
	21.06.2022	91.43	47.5	18.6	32.2	24.2	13.4	ND	ND	ND	ND	ND	0.89
	18.07.2022	90.21	46.4	16.3	31.1	25.1	34.4	ND	ND	ND	ND	ND	0.84
	22.08.2022	84.21	36.4	12.3	29.1	23.2	13.6	ND	ND	ND	ND	ND	0.97
	23.09.2022	86.22	36.8	12.9	27.1	20.2	11.4	ND	ND	ND	ND	ND	1.14
AAQ-4	23.04.2022	93.9	51.3	12.6	32.1	29.4	11.6	ND	ND	ND	ND	ND	0.62
	20.05.2022	92.8	50.6	11.7	30.9	28.6	10.4	ND	ND	ND	ND	ND	0.76
	21.06.2022	92.9	49.3	13.6	32.0	29.0	11.4	ND	ND	ND	ND	ND	0.96
	18.07.2022	90.7	48.3	14.6	31.6	28.4	11.8	ND	ND	ND	ND	ND	1.02
	22.08.2022	86.9	45.3	13.6	28.4	23.3	11.6	ND	ND	ND	ND	ND	1.32
	23.09.2022	88.4	46.2	14.5	26.3	21.8	12.7	ND	ND	ND	ND	ND	1.22
Descriptive Statistic	Min	84.21	36.40	10.40	19.50	20.20	10.10	ND	ND	ND	ND	ND	0.62
	Max	97.82	57.70	18.60	35.40	29.40	34.40	ND	ND	ND	ND	ND	1.32
	Mean	91.15	49.82	13.58	30.42	25.63	12.77	ND	ND	ND	ND	ND	0.90
	SD	3.33	5.41	1.82	3.58	2.50	4.61	ND	ND	ND	ND	ND	0.16

Standards: PM10-100, PM2.5-60, SO2-80, NO2–80, NH3–400, O3-100, Pb -1.0, C6H6–5.0, (Units: micro gram/meter3), As - 6.0, B(a)P - 1.0, Ni – 20.0 (units – Nano gram/meter3), CO – 2.0 mg/m

Particulate load (PM_{10} and $PM_{2.5}$)

In the study area, particulate load was found in moderated concentration but well within the limit as per ECR 1997 guideline for 24 Hrs. monitoring. Descriptive statistic shows that the particulate load viz. PM10 was varied from 84.2 to 97.82 µg/m3 with means value of 91.15 µg/m3. Similarly, standard deviation of the studied sample shows that the air quality of the study area having wide variation with one to another. Such observation was noted mainly due to different land use pattern of the location. In the spatial view, elevated concentration of particulate was noted at AAQ-2 Pindrabera area and location is densely populated with wide industrial complex like iron industry and crushing industry. In addition, the area having high traffic congestion with narrow road. All these observations indicated that the elevated level of the particulate load which mainly due to traffic congestion, and anthropogenic activities from the area which contribute additional amount of particulate in the regional atmosphere **Figure 2.1**.

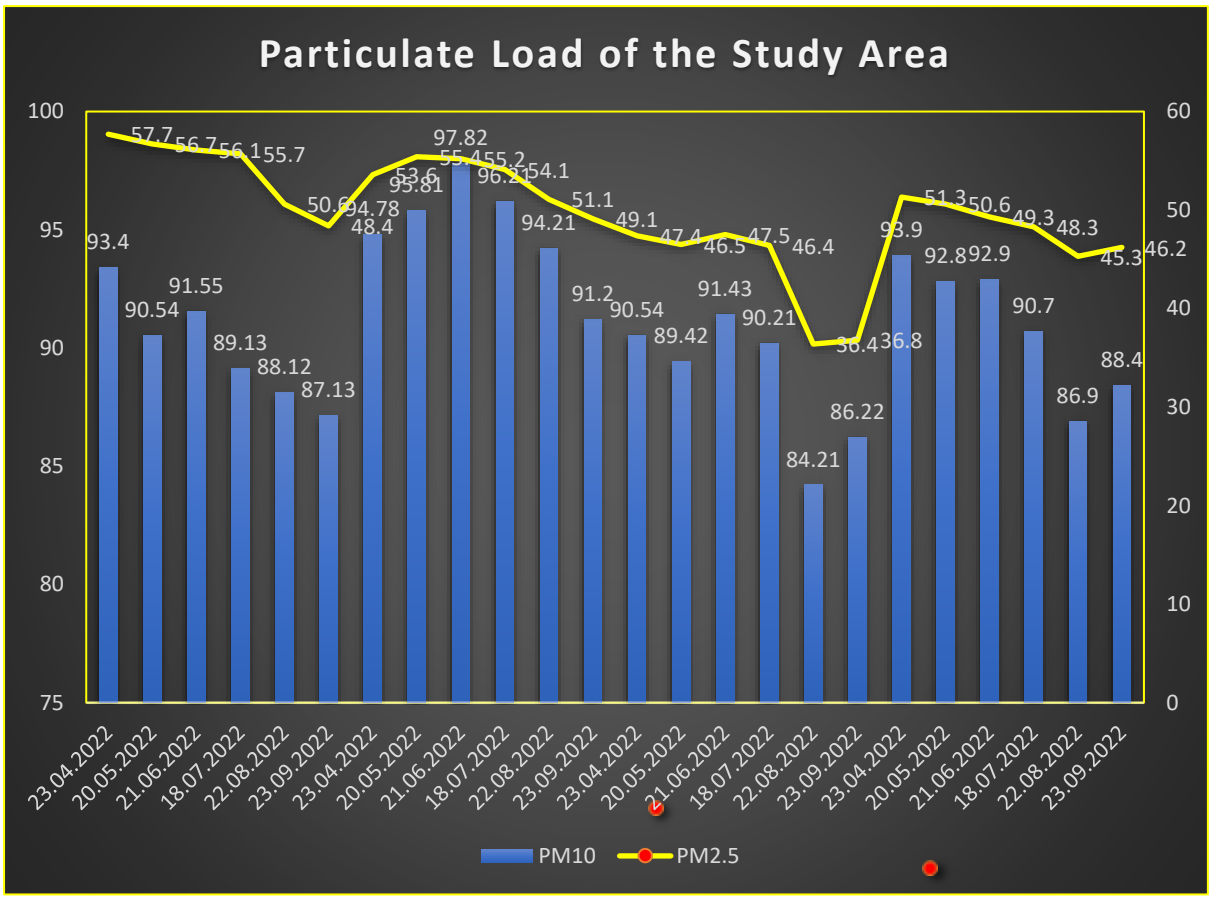
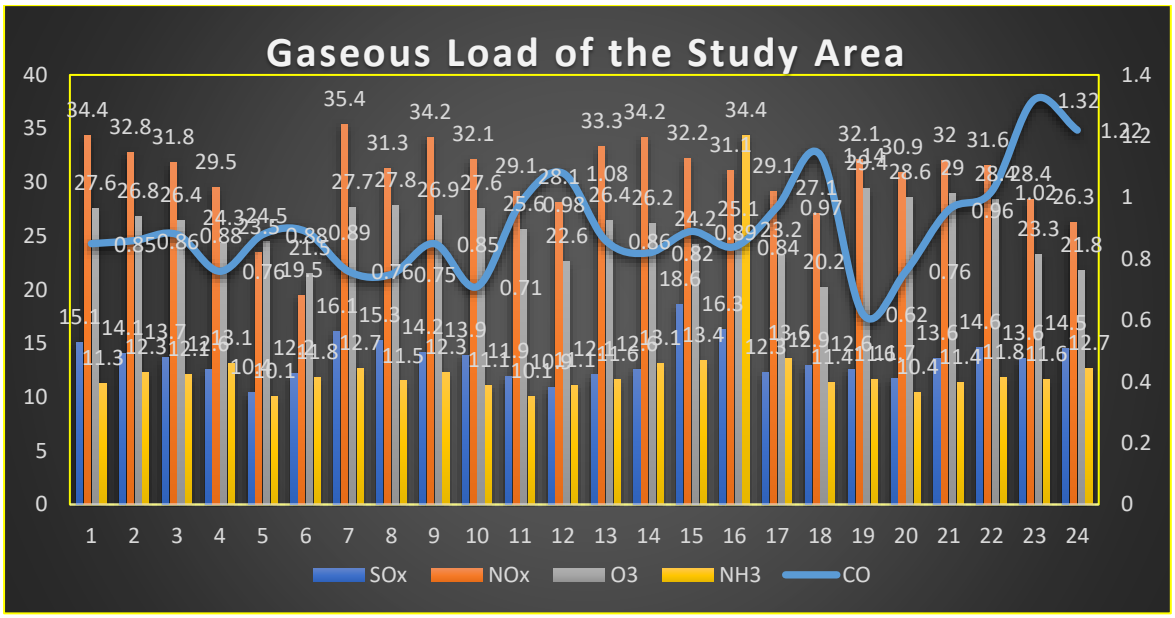


Figure 2.1: Particulate Load of the Study Area

Gaseous parameters

The parameter like Sox, Nox, CO and O3 were found well and within the limit at location. Descriptive statistic show that SOx was varied from 10.4 to 18.6 µg/m^3 and Nox varied from 19.5 to 35.4 µg/m^3, CO varied from 0.62 to 1.32 mg/m^3 and O3 varied from 20.2 to 29.4 µg/m3 with mean value of 13.58 µg/m3, 30.42 µg/m^3, 25.63 µg/m3, 0.9 µg/m3,and 12.77 µg/m^3 respectively **Figure 2.2**.

Figure 2.2: Gaseous Load of the Study Area



2.2.2 Fugitive Emission

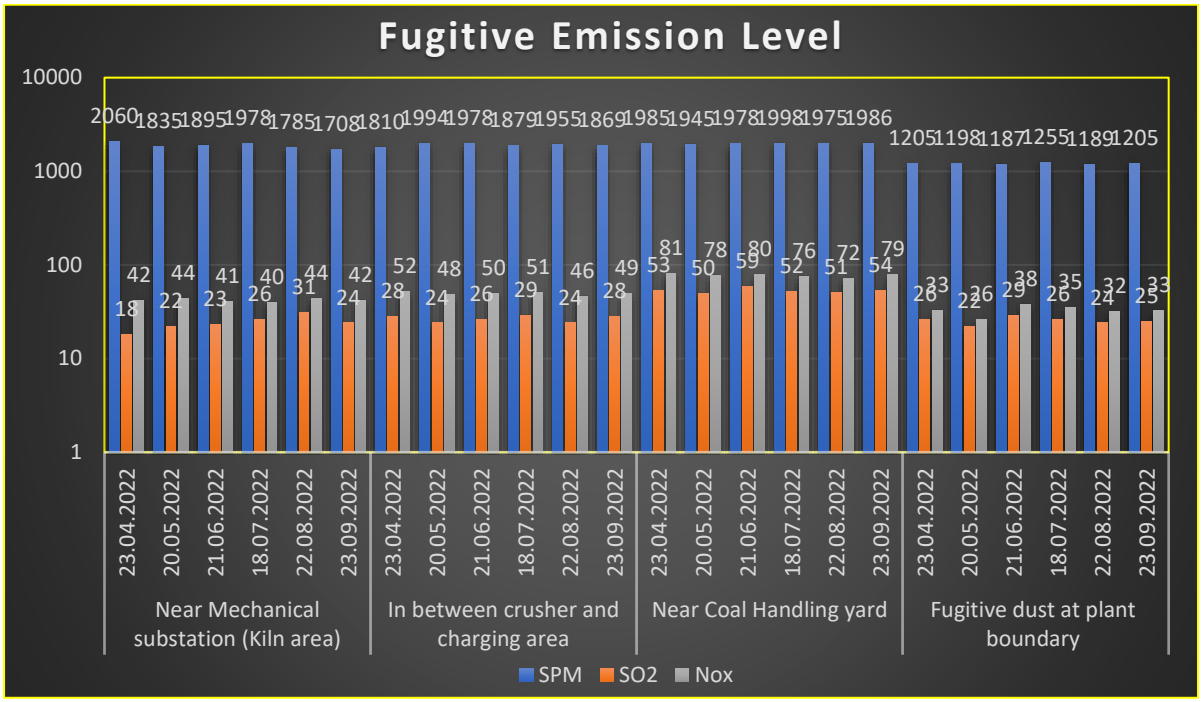
Fugitive (no ducted) emissions, in fact, contribute to the air quality impact of industrial operations and could be added to the effects of stack emissions. Fugitive emissions are generally due to equipment leaks (ESA, 2005), emissions from the bulk handling or processing of raw materials, windblown dust and a number of other specific industrial processes. Vehicular traffic around storage piles, comprising the movement of front-end loaders, bulldozers and trucks, can generate fugitive dust emissions from a dust-laden surface, usually the storage pile material. Additionally, fugitive emissions escape from reactor vessels during charging, process heating and tapping.

Table 2. 2: Fugitive Emission Level of the study area

Code	Location Name	Date of sampling	SPM	SO2	Nox
FEQ-1	Near Mechanical substation (Kiln area)	23.04.2022	2060	18	42
		20.05.2022	1835	22	44
		21.06.2022	1895	23	41
		18.07.2022	1978	26	40
		22.08.2022	1785	31	44
		23.09.2022	1708	24	42
FEQ-2	In between crusher and charging area	23.04.2022	1810	28	52
		20.05.2022	1994	24	48
		21.06.2022	1978	26	50
		18.07.2022	1879	29	51
		22.08.2022	1955	24	46
		23.09.2022	1869	28	49
FEQ-3	Near Coal Handling yard	23.04.2022	1985	53	81
		20.05.2022	1945	50	78
		21.06.2022	1978	59	80
		18.07.2022	1998	52	76
		22.08.2022	1975	51	72
		23.09.2022	1986	54	79
FEQ-4	Fugitive dust at plant boundary	23.04.2022	1205	26	33
		20.05.2022	1198	22	26
		21.06.2022	1187	29	38
		18.07.2022	1255	26	35
		22.08.2022	1189	24	32
		23.09.2022	1205	25	33

These emissions constitute a big problem for air quality control because they contain large quantities of fine particulate with smaller amounts of vaporous metals and organics in hot and corrosive gas streams. However, the study find that emission of particulate load was found within the permissible limit **Table 2.2 and Figure 2.3.**

Figure 2. 3: Fugitive Emission level of the study area



2.2.3 Stack Emission Load

NIPL effort to control ducted emissions from stacks, ducts or flues, which are carried to the point of discharge in confined flow streams. Control strategies are based on the assumption that the primary air quality impact of industrial operations results from the discharge of air pollutants from conventional ducted sources. The study shows that emission of particulate from ducts were found below the regulatory standard **Table 2.3 and Figure 2.4**. For improvement of control devices, we are regularly clean the waste with help of housekeeping and mechanically calibrate it on certain interval by inhouse and third-party inspection company.

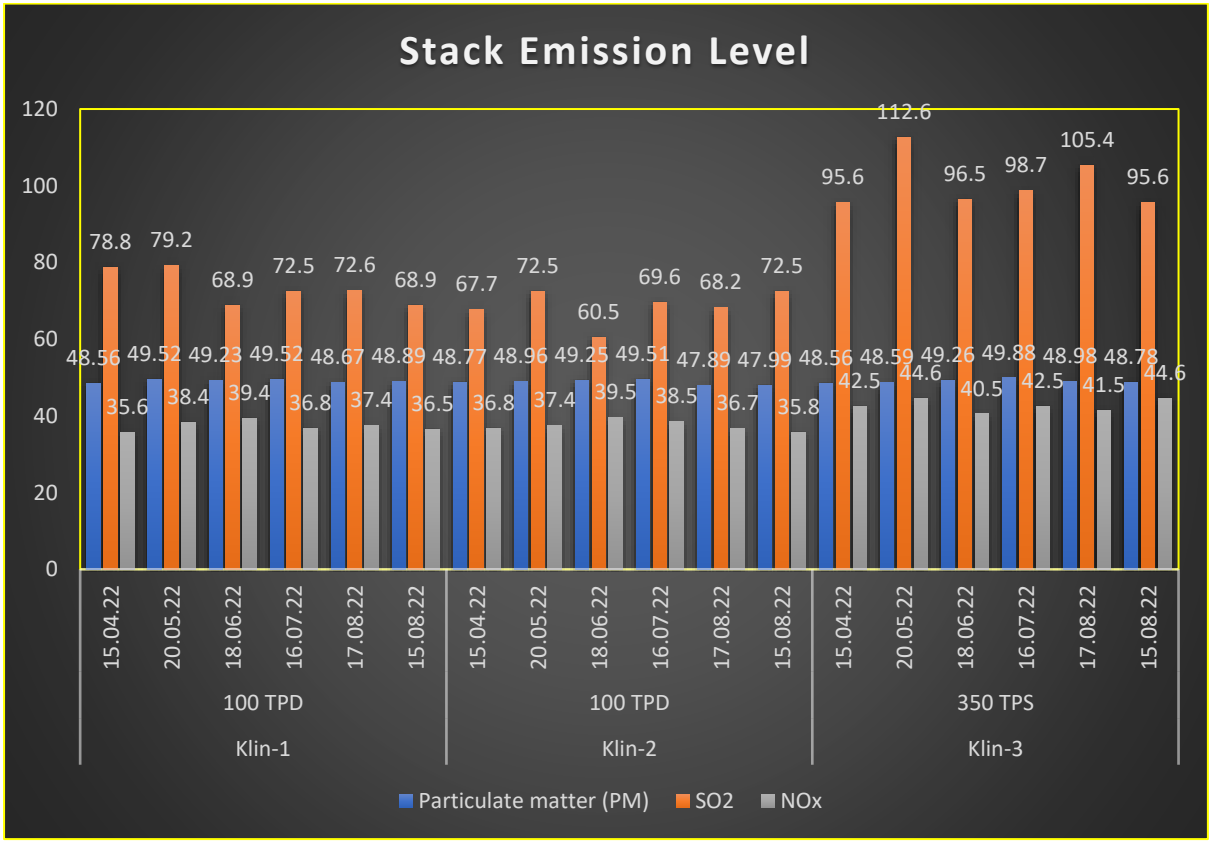
Table 2. 3: Stack Emission level of the DRI plant

Name of the Plant	Stack	Height of the stack (m)	Pollution Control	Internal Diameter	Prod-uction	Date & Time	Flow rate	Parameters (whichever are applicable)				
1	2	3	4	5	6	7	8	9				
Refractory Material plant							**(NM3 /Hr)**	Particulate matter (PM)	SO2	NOx	HC	CO
								(mg/Nm3)				Vol./vol.
Klin-1	**Stack-1**	**45 meters**	**ESP's**	**1.5 meters**	**100 TPD**	15.04.22	24484	48.56	78.8	35.6	-	<0.2%
						20.05.22	23945	49.52	79.2	38.4	-	<0.2%
						18.06.22	24502	49.23	68.9	39.4	-	<0.2%
						16.07.22	24217	49.52	72.5	36.8	-	<0.2%
						17.08.22	23978	48.67	72.6	37.4	-	<0.2%
						15.08.22	24566	48.89	68.9	36.5	-	<0.2%
Klin-2	**Stack-1**	**45 meters**	**ESP's**	**1.5 meters**	**100 TPD**	15.04.22	23596	48.77	67.7	36.8	-	<0.2%
						20.05.22	23874	48.96	72.5	37.4	-	<0.2%
						18.06.22	24109	49.25	60.5	39.5	-	<0.2%
						16.07.22	24212	49.51	69.6	38.5	-	<0.2%

						17.08.22	23789	47.89	68.2	36.7	-	<0.2%
						15.08.22	23667	47.99	72.5	35.8	-	<0.2%
Klin-3	**Stack-2**	**65 meters**	**ESP's**	**3.5 meters**	**350 TPS**	15.04.22	195040	48.56	95.6	42.5	-	<0.2%
						20.05.22	194935	48.59	112.6	44.6	-	<0.2%
						18.06.22	195229	49.26	96.5	40.5	-	<0.2%
						16.07.22	194878	49.88	98.7	42.5	-	<0.2%
						17.08.22	195648	48.98	105.4	41.5	-	<0.2%
						15.08.22	194869	48.78	95.6	44.6	-	<0.2%

Standards: PM - 50, SO2 - , NOx - , CO - (Units: mg/Nm3)
Monitoring values for corresponding Kiln duct (Klin-1 & Klin-2). Two Kilns through individual Ducts are connected to a common stack.

Figure 2. 4: Stack Emission level of the DRI plant



2.3 Noise Quality

2.3.1 Ambient Noise Quality

Ambient day time highest noise level (Leq $_{day}$) was recorded 67.9 dB(A) at NQ-1 while lowest value was 49.2 dB(A) at NQ48. Similarly Ambient nighttime highest noise level (Leq $_{night}$) was recorded 52.7 67.9 dB(A) at NQ-2 while lowest value was 36.6 67.9 dB(A) at NQ-4 **Table 2.4 and Figure 2.5**. From the analysis data it has been found that most of the noise level of monitoring station exceeds the standard during the day time except NQ-4 **Figure 2.6.** Noise level exceeds the standard level due to the huge number of traffic movement during day and night time. The study shows that the noise level of three location were very comparable to each other in terms of noise level. Similarly, noise level of all three locations was found within the regulatory standard as under consideration of Industrial zone and commercial zone standard.

Table 2. 4: Ambient Noise Level of the Study Area

S.N	Location	NQ-1	NQ-2	NQ-3	NQ-4
		Commercial	Residential	Residential	Silent
Day Time	6.00 am	60.7	52.8	52.6	39.4
	7.00 am	61.6	52.0	57.0	41.3
	8.00 am	56.7	56.7	62.1	41.2
	9.00 am	57.1	57.3	60.5	43.1
	10.00 am	62.1	53.7	60.5	44.1
	11.00 am	62.3	63.8	57.9	46.3
	12.00 pm	60.9	64.2	52.5	46.9
	13.00 pm	61.9	58.1	49.9	47.4
	14.00 pm	67.9	58.5	48.9	48.3
	15.00 pm	65.1	61.2	52.8	53.7
	16.00 pm	75.5	56.0	52.3	55.1
	17.00 pm	76.3	61.8	51.9	53.6
	18.00 pm	59.8	56.0	49.8	50.1
	19.00 pm	63.5	54.6	49.2	50.5
	20.00 pm	54.5	51.8	41.2	44.3
	21.00 pm	52.1	56.1	41.7	39.8
	Lday	**67.9**	**58.9**	**55.1**	**49.2**
	Standard	**65**	**55**	**55**	**50**
Night Time	22.00 pm	57.6	51.0	46.9	40.5
	23.00 am	46.6	41.2	38.5	36.7
	24.00 am	47.4	53.6	37.9	36.0
	1.00 am	41.8	55.7	51.4	34.3
	2.00 am	43.1	54.2	35.9	34.3
	3.00 am	47.4	54.5	35.8	33.8
	4.00 am	52.8	52.5	33.9	35.7
	5.00 am	52.6	46.8	47.9	37.5
	Lnight	**51.2**	**52.7**	**44.5**	**36.6**
	Max	76.3	64.2	62.1	55.1
	Min	41.8	41.2	48.9	33.8
	Standard	**55**	**45**	**45**	**40**

Figure 2. 5: Noise Pattern of the study area during 24 hr monitoring period

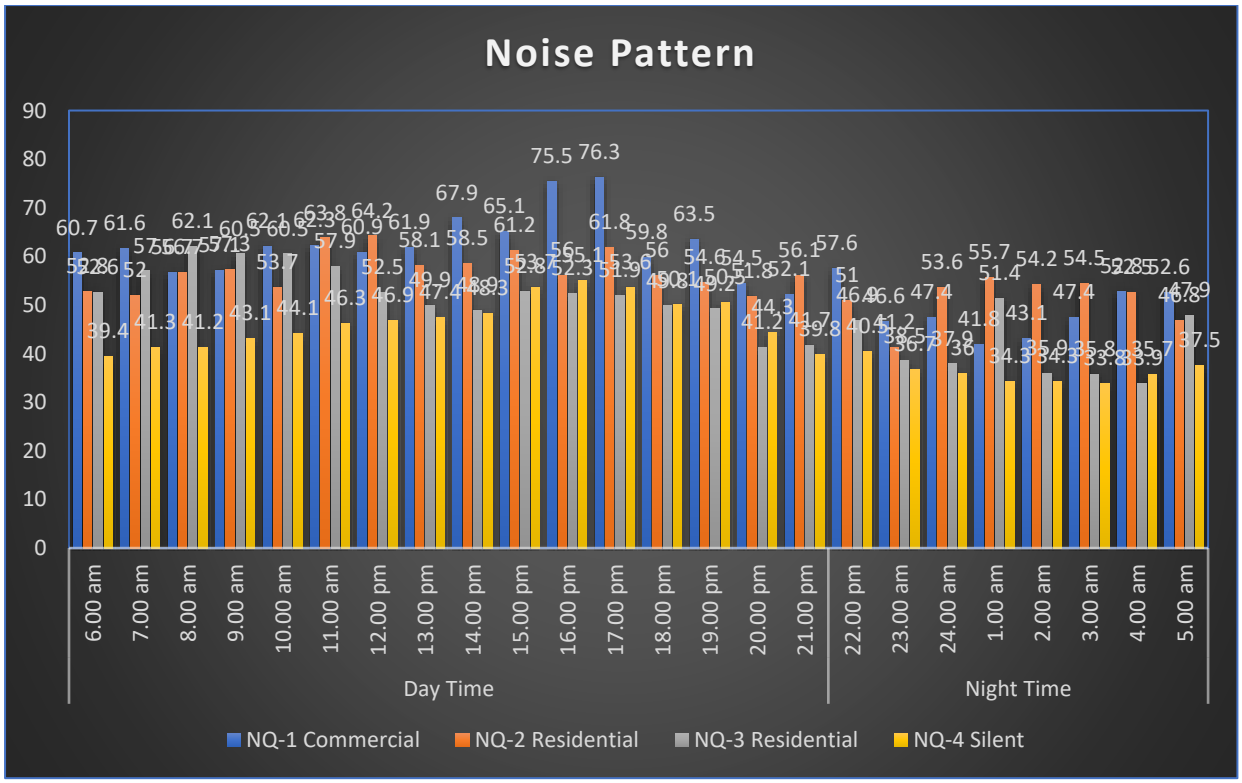
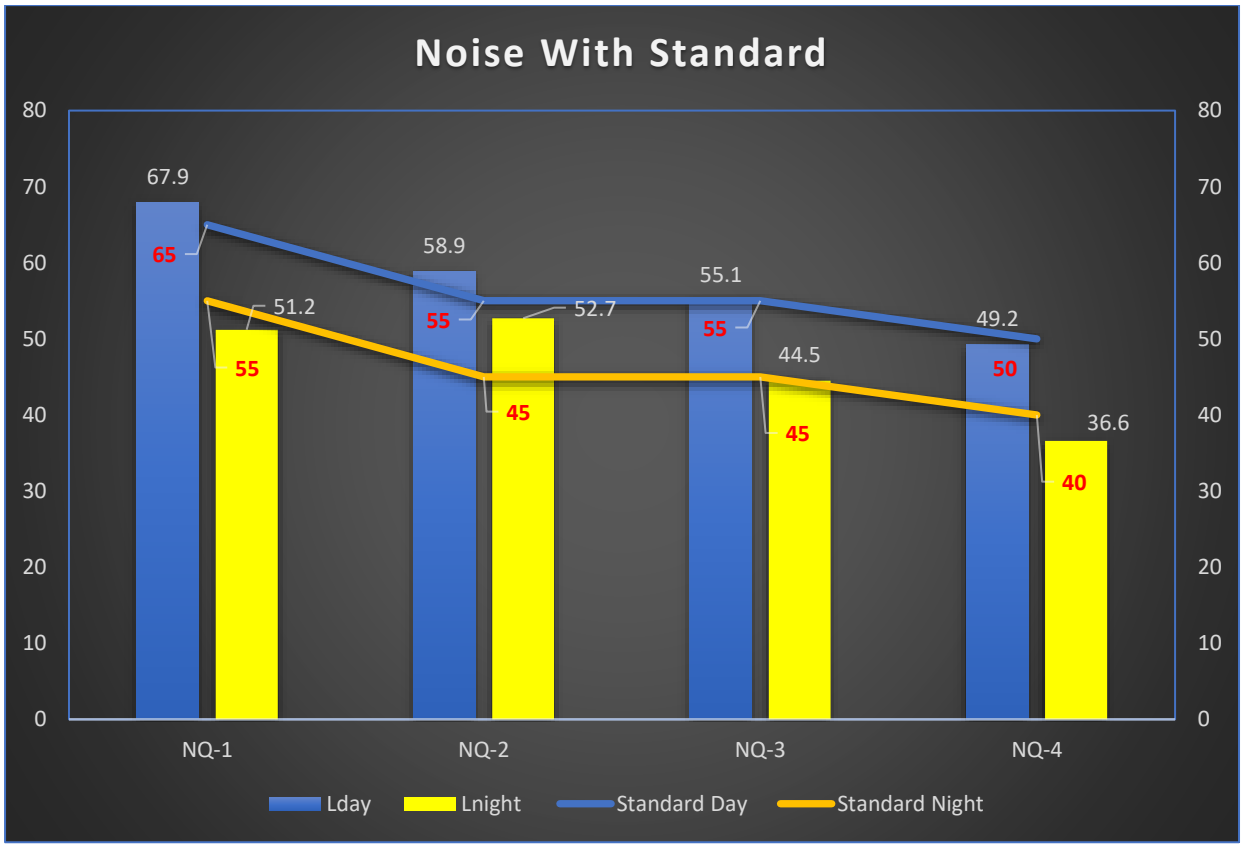


Figure 2. 6: Noise comparison with standard



The values of noise level, which were recorded, and the level was well within the permissible limit as per the ambient noise standard in night time. In the study area, there are number of activities that could generate noise emission like project development activity, power generator, traffic, and other natural source like animal snoring, rain, thunderstorm and wind blow etc.

2.3.2 Work Zone Noise Quality

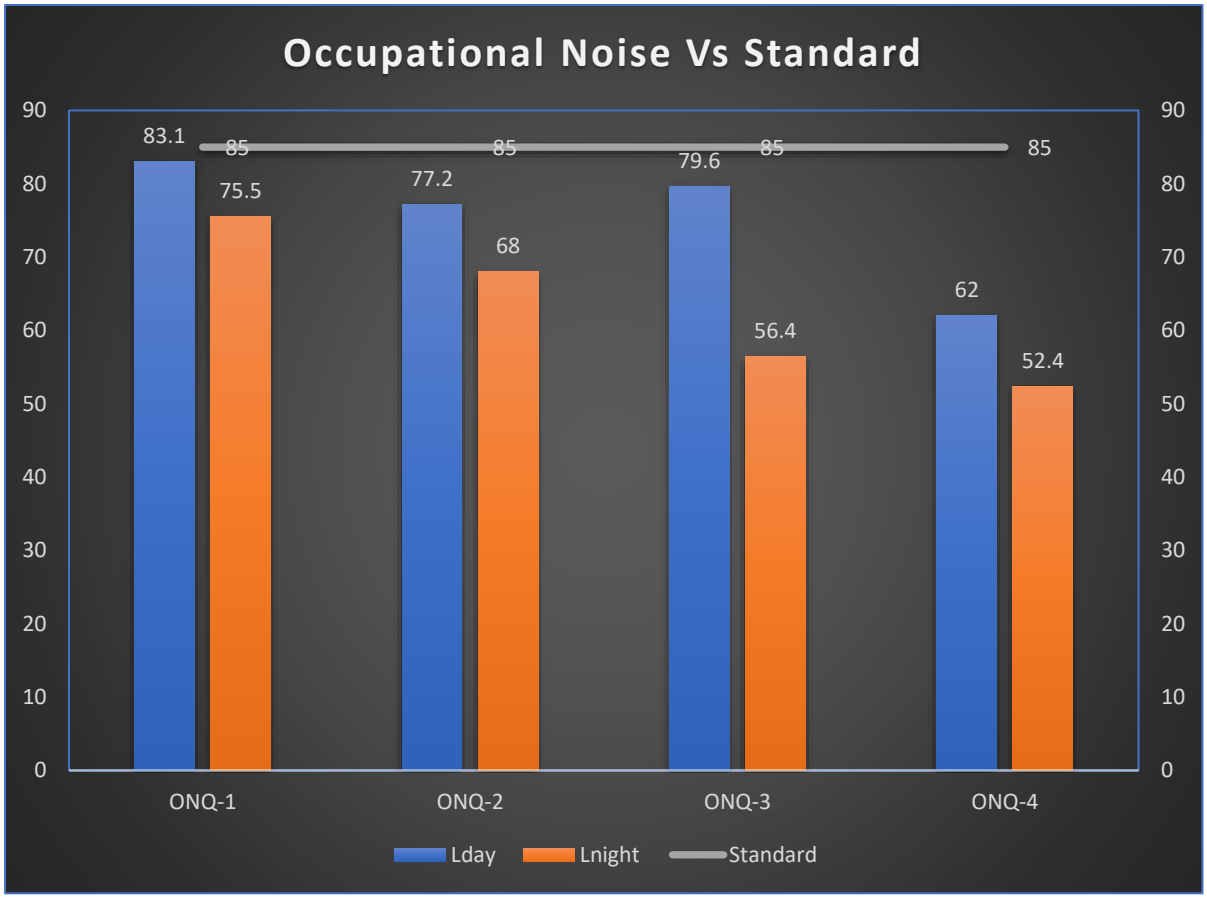
OSHA's permissible exposure limit (PEL) is **90 dBA for all workers for an 8-hour day**. Each industry is different, as workers' tasks and equipment differ, but most regulations agree that noise becomes hazardous when it exceeds **85 decibels**, for an 8-hour time exposure (typical work shift). In this study, four locations were targeted for the study **Table 2.5.** The Study show that the area noise is well within limit at night time and slightly comparable during day time with standard **Figure 2.7.**

Table 2. 5: Occupational Noise level of the study area

S.N	Location	ONQ-1	ONQ-2	ONQ-3	ONQ-4
Day Time	6.00 am	61.1	61.9	53.4	48
	7.00 am	58.6	74.9	67	50.9
	8.00 am	65.8	79	64.5	59.8
	9.00 am	72.9	72.4	62.3	61.7
	10.00 am	79.7	72.7	70.1	59.3
	11.00 am	77.0	81.2	71.5	50.8
	12.00 pm	79.2	72.5	73.9	70.7
	13.00 pm	76.0	73.6	80.3	53.8
	14.00 pm	89.5	78.6	82.2	60.7
	15.00 pm	82.7	80.7	86.5	45.6

	16.00 pm	84.7	83.5	83.8	43.4
	17.00 pm	80.5	69.2	76.8	46
	18.00 pm	78.4	70.5	80.5	47.5
	19.00 pm	72.3	73.5	84.5	55.8
	20.00 pm	69.0	73.8	64.6	66.4
	21.00 pm	63.8	75.8	60.4	65.5
	Lday	**83.1**	**77.2**	**79.6**	**62**
Night Time	22.00 pm	83.1	62.5	62.8	57
	23.00 am	72.9	62.3	60.6	43.8
	24.00 am	60.9	73.5	51.5	44.5
	1.00 am	69.5	73.5	49.5	42.2
	2.00 am	76.5	47.5	42.4	47
	3.00 am	72.5	48.3	48	53.9
	4.00 am	49.5	57.3	47.3	56.5
	5.00 am	60.1	62.4	46.7	49.4
	Lnight	75.5	**68**	**56.4**	**52.4**
	Max	89.5	**47**	**42.4**	**42.2**
	Min	49.5	**83.5**	**86.5**	**70.7**

Figure 2. 7: Noise level comparison with standard



2.4 Water Quality

2.4.1 Surface Water Quality

Surface water of the study area is characteristic into two classes one is belong to pond water and other is belong to pond water. The studied result is tabulated in the **Table 2.6.**

1. pH of surface water shows neutral in the nature and varied from 6.72 to 7.4 in the five samples.
2. Dissolved oxygen shows good condition of water and varied from the 5.3 to 6.2 mg/l in five samples which indicate water bodies are well oxygenated and suitable for aquatic life **Figure** 2.8.
3. TDS varied from the 184 to 362 mg/l in three samples which mainly due to naturally abundance of salts in the water. Similarly, EC varied from 298 to 574 uS/cm which isa also evidence of mineralisation of water through natural process like rock water interaction, ion exchange, weathering etc.
4. BOD level of three samples were found within suitable and but COD was slightly elevated in the studied sample that evidence of minimal organic load in the water bodies of the study area. Similar observation is observed with bacterial load which is also evidence organic load through man made activities like open defecation and lithogenic influx from agricultural activities.
5. The heavy metals like Pb and As were found below the detection limit at all location which indicates that the water is not contaminated from any metallic pollution.

Table 2. 6: Surface Water Quality of the Study Area

S.N.	Parameters	Unit	SW1	SW2	SW3	SW4	SW5	Standard
	Date of Sampling		23.04.2022					
	Whether Pond/River/Sea		**River**	**River**	**Pond water**	**Pond water**	**Pond water**	
(I)	**Physico-chemical Parameters**							
1	Colour	Hazen	<1.0	<1.0	<1.0	<1.0	<1.0	10
2	pH value	None	7.4	6.72	7.3	6.98	6.88	6.5-8.5
3	Conductivity	us/cm	553	574	446	298	317	1000*
4	Total Dissolved Solids	mg/l	310	362	274	184	196	500
5	Dissolved Oxygen	mg/l	5.6	5.7	5.3	6.2	6.0	6
(II)	**Chemical Parameters**							
6	Chloride (as Cl)	mg/l	38	26	46	22	24	250
7	Fluoride (as F)	mg/l	<0.02	<0.02	<0.02	<0.02	<0.02	1.5
8	Iron (as Fe)	mg/l	0.19	0.17	0.2	0.32	0.48	0.3
9	Nitrate (as NO3)	mg/l	<0.02	<0.02	<0.02	<0.02	<0.02	20
10	Sulphate (as SO4)	mg/l	5	3.9	5	6.2	3.7	400
11	Lead (as Pb)	mg/l	<0.005	<0.005	<0.005	<0.005	<0.005	0.1
12	Arsenic(as As)	mg/l	<0.005	<0.005	<0.005	<0.005	<0.005	0.05
13	Biochemical Oxygen Demand	mg/l	10	8.4	9.8	5.8	6.2	2
14	Chemical Oxygen Demand	mg/l	40	32	39	24	27	-
15	Oil and Grease	mg/l	<1.4	<1.4	<1.4	<1.4	<1.4	-
(III)	**Bacteriological Parameters**							
16	Total coliform bacteria	MPN/100ml	170	100	114	140	145	50
17	Faecal coliform	MPN/100ml	68	49	40	45	30	-

Surface water quality criteria for different uses (specified by CPCB, 1979 and the Bureau of Indian Standards, 1982)

Figure 2. 8: Physico-chemical parameters of the Study Area

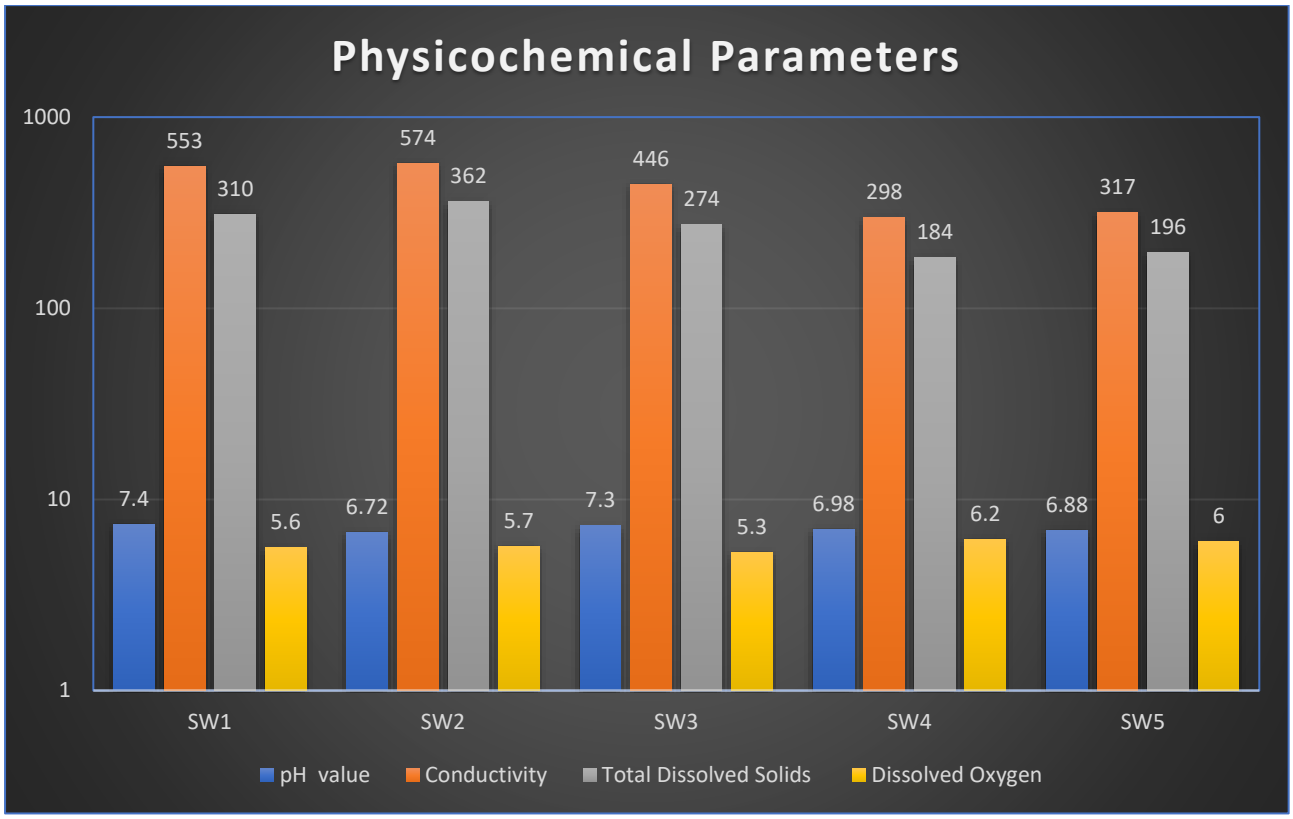
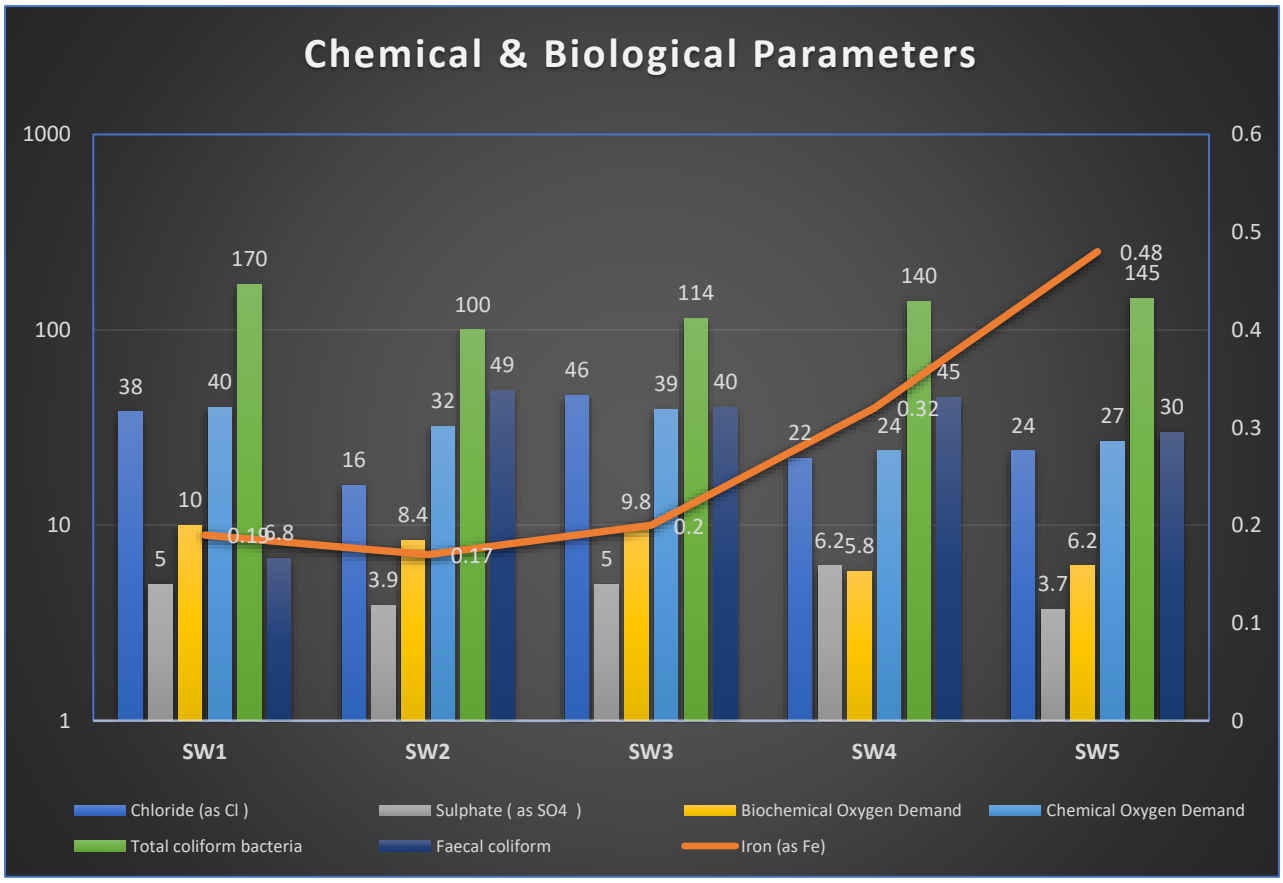


Figure 2. 9: Chemical and Biological Parameters of the study area



2.4.2. Groundwater

There are five locations were targeted for study of groundwater and supplied water in view of portability uses in the plant and nearest villages. The summary of inferences of the analysis of the ground water samples results are presented in the following **Table 2.7.**

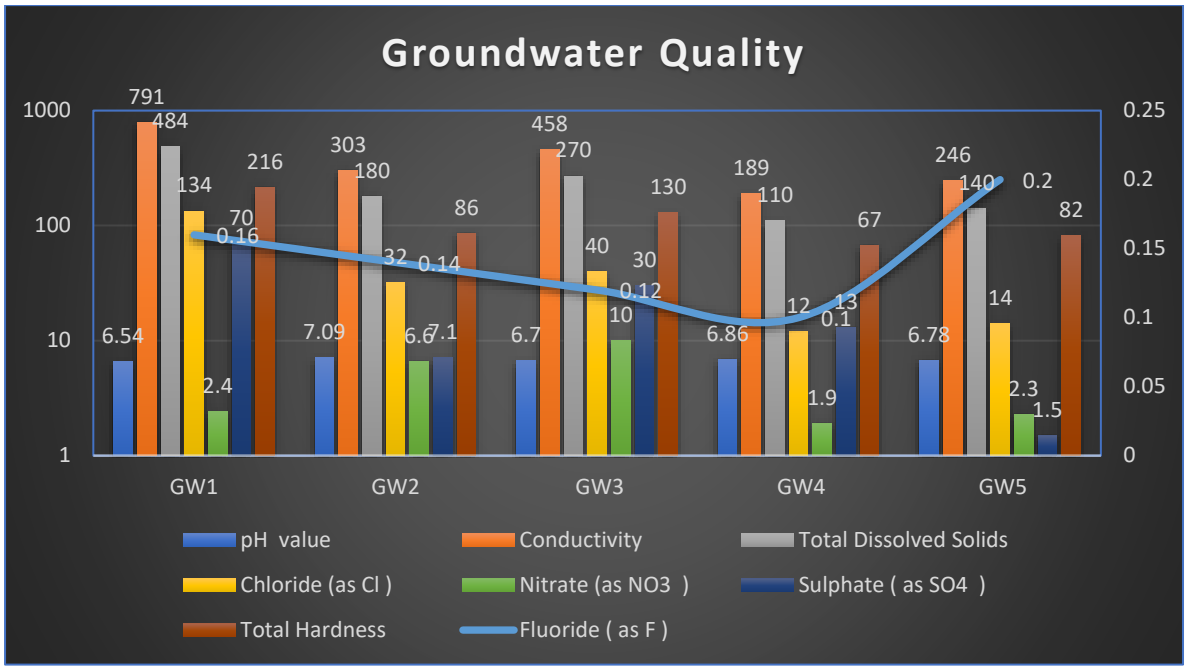
Table 2. 7: Groundwater Quality of the Study Area

S.N.	Parameters	Unit	GW1	GW2	GW3	GW4	GW5	Standard
	Date of sampling		23.04.2022					
	Source		Admin building	Worker Shed	Raghunathpur Village	Kandra Village	Raimara Village	
1	pH value	None	6.54	7.09	6.7	6.86	6.78	6.5-8.5
2	Conductivity	us/cm	791	303	458	189	246	-
3	Total Dissolved Solids	mg/l	484	180	270	110	140	500
4	Chloride (as Cl)	mg/l	134	32	40	12	14	250
5	Fluoride (as F)	mg/l	0.16	0.14	0.12	<0.1	0.2	0.05
6	Nitrate (as NO3)	mg/l	2.4	6.6	10	1.9	2.3	45
7	Sulphate (as SO4)	mg/l	70	7.1	30	13	1.5	200
8	Total Hardness	mg/l	216	86	130	67	82	200
9	Iron (as Fe)	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	0.3
10	Copper (as Cu)	mg/l	<0.02	<0.02	<0.02	<0.02	<0.02	0.05
11	Cadmium (as Cd)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	0.003
12	Lead (as Pb)	mg/l	<0.005	<0.005	<0.005	<0.005	<0.005	0.01
13	Mercury (as Hg)	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
14	Arsenic(as As)	mg/l	<0.005	<0.005	<0.005	<0.005	<0.005	0.01
15	Total Chromium (as Cr)	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	0.05

Standard: *Guidelines for Drinking Water Quality, Second Revision, Clause 4, Drinking Water — Specification, IS 10500: 2012*

1. pH of the samples was found neutral in range (6.54 to 7.09) and under the permissible limit and healthy for human consumption.
2. Chloride is slightly moderate and ranges from 14 to 134 mg/l which mainly dominance of rock water interaction in to the aquifer that enhance the natural mineralization process in the groundwater.
3. Nitrate and Nitrite of the studied sample were found in the sample but below the drinking water standard. However, presence of nitrate compound in the groundwater is the evidence of leaching of organic contaminates from leaching process.
4. Other parameters like metals and metalloids like Arsenic, Manganese, Zinc, were noted below the standard limits which suggest that water of the study area is not affected by any metallic pollution.
5. Overall study suggests that water quality of the studied area is well and within suitable range. Additionally, the aquifer of this area is untouched with any major organic or inorganic pollution from any human activities **Figure 2.10.**

Figure 2. 10: Groundwater Quality of the Study Area



2.4.3 Waste Water

Six sample were collected simultaneously from existing STP outlet water to estimation of the waste water quality and their results have been tabulated in the **Table 2.8** and **Figure 2.11** The results of waste water quality monitoring are summarized below;

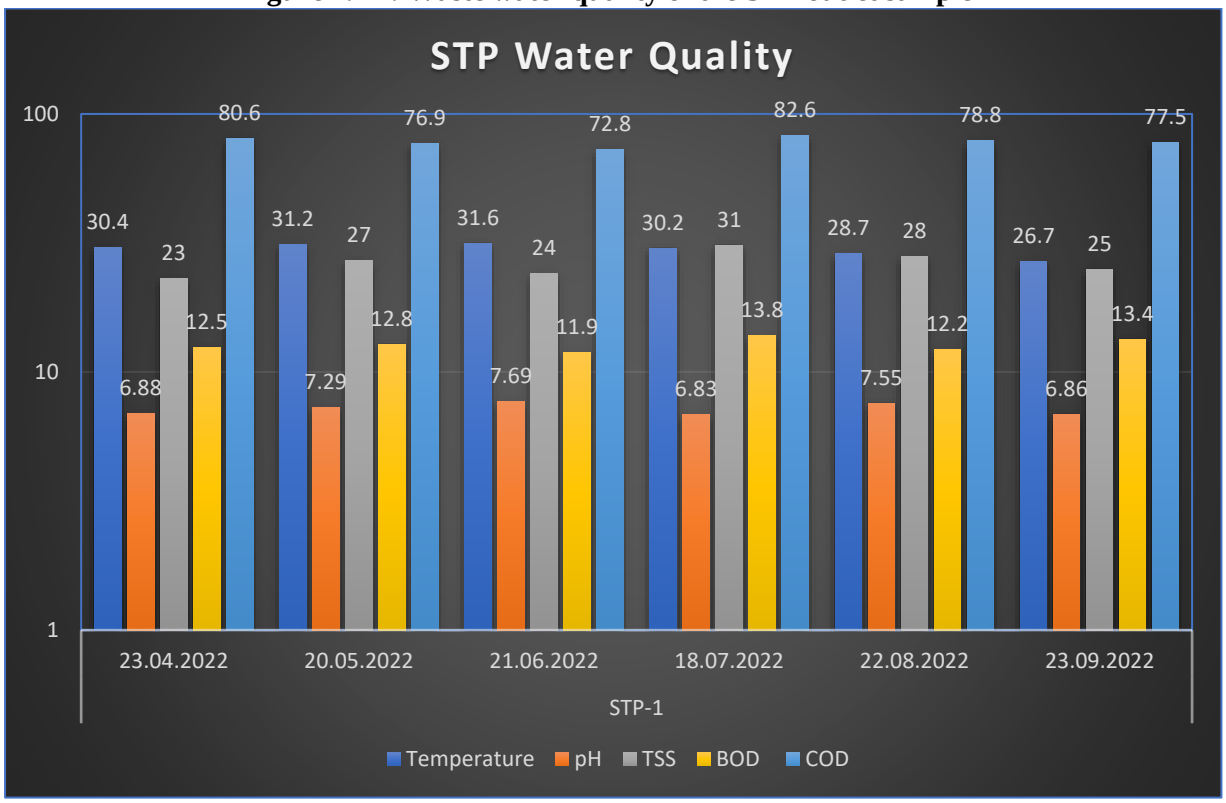
- ✓ pH of waste water shows neutral to slightly alkaline in the nature which indicate the treated waste water is under suitable range for discharge in the surface water bodies.
- ✓ Biochemical Parameters like BOD and COD were found above possible limit. Bacteriological parameters like Total Coliform were found above the permissible range in all the studied samples.
- ✓ The other suspended, volatile and Settleable were found under control condition at all time which fulfils the discharge cafeteria of treated waste water and can be recuse in the plant dust suppression and other activities.

Table 2. 8: Waste water Quality of the STP Outlet Sample

Name of STP	Date of Sampling	Temperature	pH	TSS	Phenol	Cyanide	BOD	COD	Remark
STP-1	23.04.2022	30.4	6.88	23	<0.01	<0.02	12.5	80.6	
	20.05.2022	31.2	7.29	27	<0.01	<0.02	12.8	76.9	
	21.06.2022	31.6	7.69	24	<0.01	<0.02	11.9	72.8	
	18.07.2022	30.2	6.83	31	<0.01	<0.02	13.8	82.6	
	22.08.2022	28.7	7.55	28	<0.01	<0.02	12.2	78.8	
	23.09.2022	26.7	6.86	25	<0.01	<0.02	13.4	77.5	
Standard		400C	6.0-8.5	100,	1.0	0.20	30,	250.	

Standard: *The Environment (Protection) Rules, 19861 [SCHEDULE – VI] (See rule 3A) GENERAL STANDARDS FOR DISCHARGE OF ENVIRONMENTAL POLLUTANTS PART-A : EFFLUENTS*

Figure 2. 11: Waste water quality of the STP outlet sample



2.5 Conclusion

Overall study from April 2022 to September 2022, we found that the are having good environment and under regulatory standard prescribed by SPCB, CPCB, and MoEF&CC guideline. For the better environment, we are continuously making effort to achieve the quality environment with sustainable growth. In addition, NIPL will extend this report to cover maximum compliance in return evaluation report from JSPCB and MoEF&CC and other concerned department, if any.